# ELECTRICAL CONSTRUCTION AND MAINTENANCE

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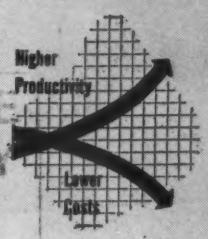



## Ways to Lower Costs

***Check list of ideas for higher productivity and lower costs in electrical construction operations.***

***Also***

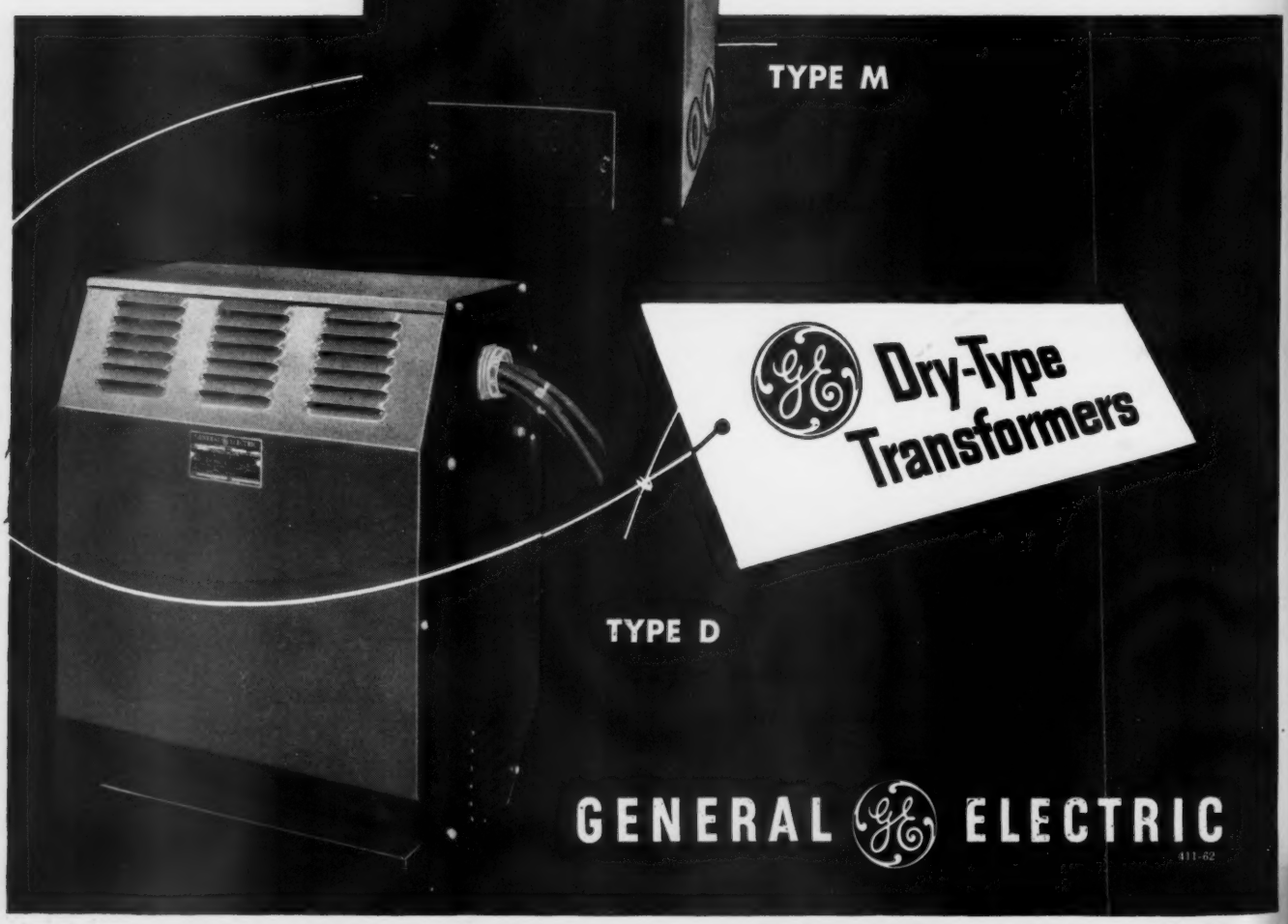
***how to plan preventive maintenance, how to design radiant heating installations, how to lay out emergency signal systems and many other practical articles—and more Reader Service.***

A McGRAW-HILL PUBLICATION

# for the Right Voltage at the Right Place

Serving lighting and small power loads directly from power circuits—*at* the load—can mean real savings. It means lower line losses, reduced wiring costs, higher efficiency—and often lower power costs. General Electric's M and D dry-type transformers are ideal for this purpose—for supplying the *right voltage at the right place.* Small and compact, they require no fireproof vaults, are easily and quickly installed, are quiet in operation, and will give you a lifetime of reliable service. They require practically no inspection or maintenance.

All M and D ratings are available for quick delivery—many standard ratings from stock. See your local electrical jobber now, or call the nearest G-E Apparatus Sales Office. *Apparatus Department, General Electric Company, Schenectady 5, New York.*



DERN
THODS mean Highest Quality . . . Latest Design . . . Greatest Value!

Breaking All Records!

SALES CHART

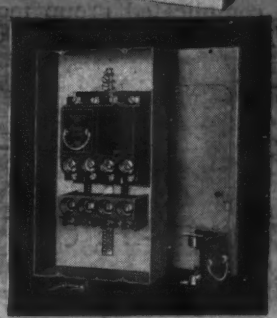
Listed by Underwriters Laboratories, Inc.

# THE Murray 8 CIRCUIT

## Combination Main Service and Range Switch

*with*

Extra Tap Connection for Hot Water Heater



**Eight branch circuits, three-wire range connections, and an extra hot water heater tap are provided in this new Murray Main Service & Range Switch. Two styles for 60 amp. 125-250 volt 3 pole service — 100 amp. service lugs. Plenty of hand room for wiring all 8 circuits and range! For surface or flush mounting. Cat. No. 74-8 (Series); Cat. No. 77-8 (Parallel).**

**Now you can equip today for tomorrow's bigger loads! The NEW Murray 8 Circuit Combination Main Service and Range Switch, for 125-250 volt service, provides for *eight* branch circuits, plus three-wire separately fused range connections. In addition, an extra tap simplifies hot water heater wiring . . . makes adding a heater later even simpler!**

**Yes, you can equip today for the loads of tomorrow — with the new Murray 8 circuit main service and range switch. For full details, contact your Murray representative, or write**

# Murray

## MANUFACTURING CORPORATION

*50 Years of Service to the Electrical Industry*

**1250 ATLANTIC AVENUE • BROOKLYN 16, NEW YORK**

**FOR TOMORROW'S LOADS . . .**

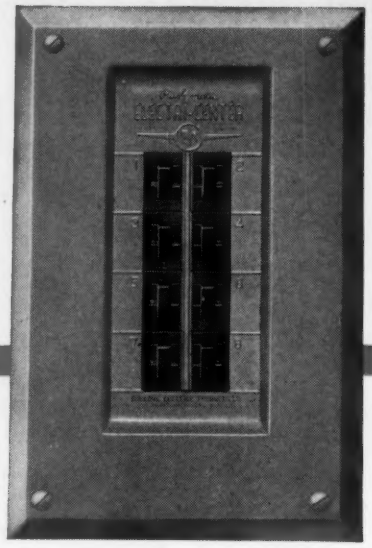
***Equip Today!***

SERVICE ENTRANCE & METER EQUIPMENT • MAGNETIC CIRCUIT BREAKERS

SWITCHES • CURRENT LIMITING REACTORS • CROWS NEST AERIAL LADDERS

# Here it is!

# NEW BULLDOG
## Service Electri-Center



*Available in 2-, 4-, or 8-circuit cabinets, the handsome Service Electri-Center is ideal for homes, offices, and small plants.* →

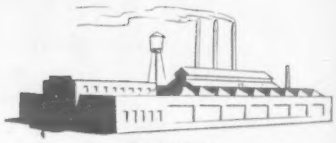
**featuring**

# *Pushmatic*

**FOR HOMES**

**COMMERCIAL BUILDINGS**

**GARAGES**



**PLANTS**

THE BULLDOG Service Electri-Center, featuring *Pushmatic*, offers ease of installation, versatility and adaptability *never before obtainable in any panelboard.* Here's why—

More compact than old-fashioned load centers, the Service Electri-Center actually contains more wiring space! Revolutionary *Pushmatic* units are responsible for this bit of magic. Two-thirds the size of a pack of cigarettes, *Pushmatic* makes the Service Electri-Center a wireman's dream.

And complicated group mountings are eliminated. Each *Pushmatic* is an individual single-pole unit, making changes and additions a simple matter.

BullDog Service Electri-Centers don't have to be hidden away in the basement or other inconspicuous and inconvenient places. Beautifully styled, this modern panelboard is at home almost anywhere.

Available in 2-, 4-, and 8-circuit cabinets, the Service Electri-Center is the last word in efficiency and protection for homes, offices, and small plants. Send the coupon today for *Pushmatic* Bulletin No. 494. It contains complete information and prices on Service ELECTRI-CENTERS and the new *Pushmatics.*

## *Pushmatic*... a new kind of control and protection

***PUSH—It's ON!***

***PUSH—It's OFF!***

***PUSH—It's ON again!***

THE revolutionary *Pushmatic* provides finger-tip control and automatic protection against short or overload. A simple push of the finger makes or breaks the circuit.

And if power is broken by short or overload, just push and service is restored. No more bothersome resetting by hand . . . no fuses to worry about. There's only one operation for this unique circuit breaker and that's PUSH!

There are four types of *Pushmatics:* THERMAL ONLY, THERMAL-MAGNETIC, or either of these types with AMBIENT COMPENSATING FEATURES. All *Pushmatics,* regardless of type or rating, are identical in size and contour and are interchangeable.

Approved by Underwriters' Laboratories, *Pushmatics* are available in ratings of 15, 20, 30, 40, and 50 amperes, 120 V., 1 pole, or 120-240 V., 2 poles, AC.

Send the coupon now for more information on why the sensational *Pushmatic* makes the BullDog Service Electri-Center the most modern panelboard available today.

**BULLDOG ELECTRIC PRODUCTS COMPANY**
DETROIT 32, MICHIGAN—FIELD OFFICES IN ALL PRINCIPAL CITIES
IN CANADA: BULLDOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO

**BULLDOG**

**HEADQUARTERS FOR ELECTRICAL DISTRIBUTION**

BULLDOG ELECTRIC PRODUCTS CO.
Detroit 32, Michigan

Please send me your Bulletin No. 494 giving full information and prices on your *Pushmatic* Service ELECTRI-CENTERS.

Name_____

Company_____

Street Address_____ Zone_____

City and State_____

F

# ELECTRICAL CONSTRUCTION AND MAINTENANCE

*With which is consolidated Electrical Contracting*
*The Electragist and Electrical Record . . . Established 1901*

A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and motor shops, covering engineering installations, repairing, maintenance and management, in the field of electrical construction and maintenance.

## October • 1949

OCTOBER—at a glance ..... 37

Expanding Industry ..... 39

Ways to Lower Costs ..... 41

Experience-tested methods for better production, lower costs and improved efficiency, a check list of current industry practices.

Preventive Maintenance Pays ..... 46

By HUGH P. SCOTT—Scheduled check-ups, cleaning and repairs, using modern methods, tools and instruments, promotes safety.

Electric Radiant Heating ..... 48

By W. T. STUART—Design consideration for system capacity and annual energy cost.

Emergency Signal Systems ..... 50

By A. A. Schuhler—How to select equipment and lay out wiring for typical emergency call installations.

Lighting Job Meets New IES Recommendations ..... 52

By T. D. WAKEFIELD—Lighting system installed in a school shows by test it meets requirements of IES recommendations.

Electricity Hatches Chicks ..... 54

By KEN J. MILLER—World's largest hatchery, completely electrified, uses 30 all-electric incubators.

Cost of Apprentice Training ..... 56

By RAY ASHLEY—Apprentice training must be carefully planned and rigidly administered.

Reader Service ..... 159

## Departments

Motor Shops ..... 59
Practical Methods ..... 109
Industrial Electrification ..... 117
Modern Lighting ..... 127
In the News ..... 135
Equipment News ..... 161
Catalogs, Bulletins, Engineering Data ..... 176
Questions on the Code ..... 181
Reader's Quiz ..... 187
Advertiser's Index ..... 192

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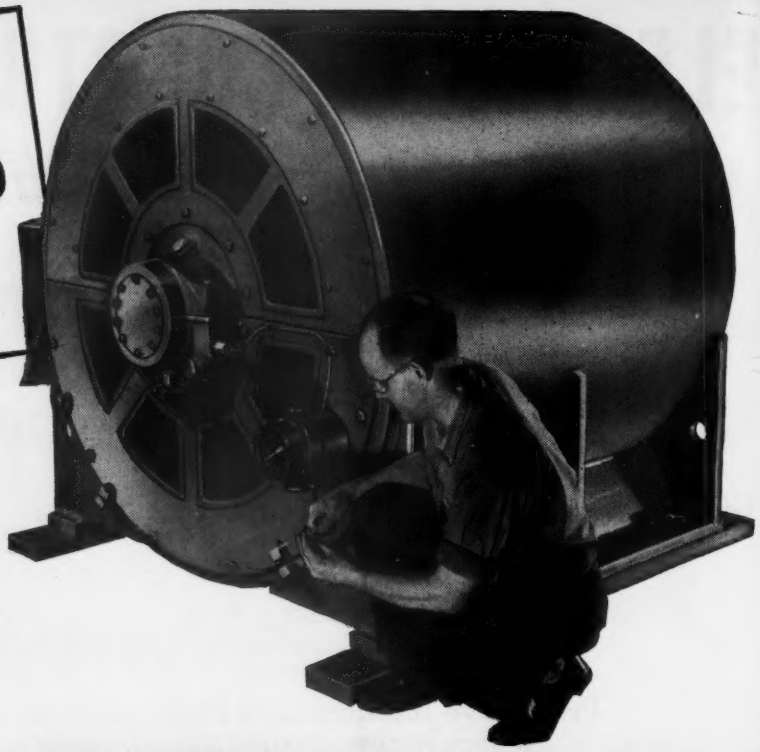
# TUBE-TYPE TOTALLY-ENCLOSED FAN-COOLED MOTORS!

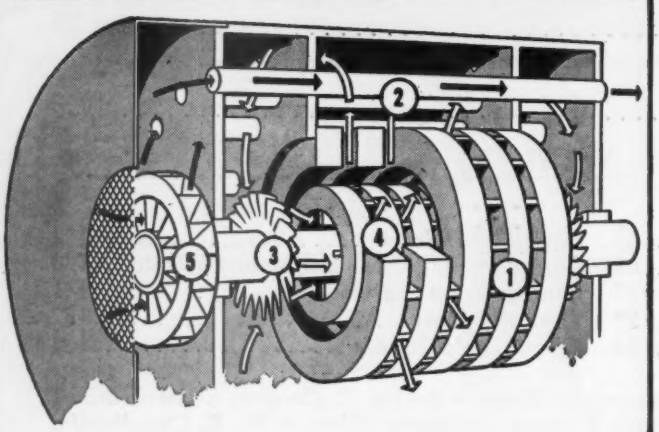


# DIRT-

## AND CORROSION-RESISTANT!

# PROOF!

### How Tube Cooling Works




Stator core (1) is surrounded by tubes (2). Internal fans (3) circulate air through ducts (4) in rotor and stator and around tubes, transferring heat to tubes.

External fan (5) drives outside air through tubes, removing heat and keeping tubes clean. All electrical parts are enclosed. Dirt cannot enter.

*Totally-Enclosed Fan Cooled

- **Install anywhere – indoors or out**
- **Heat exchanger is practically *self-cleaning***
- **Sizes . . . 75 to several thousand horsepower**

THIS ALLIS-CHALMERS tube-type TEFC* motor practically eliminates cleaning and other high maintenance costs associated with large motors exposed to dirty and corrosive atmospheres. And it does this with a simple, self-contained, tube-type, ventilating system.

All electrical parts — including the stator core — are enclosed. The simple heat transfer system keeps temperatures well within rated limits. Cleaning is rarely needed because air passages are unrestricted. Air flow through the straight tubes removes foreign matter.

Three years of field operation have proved important savings. Sizes from 75 hp and up. Also explosion-proof designs. For complete information, outline your requirements to your A-C Sales Office, or write for Bulletins 05B7150 and 51R7149.

A 2664

ALLIS-CHALMERS, 930A SO. 70 ST.
MILWAUKEE, WIS.

# ALLIS-CHALMERS

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# *No conductors cut...*

# *.. no interrupted service...*

## with New AF-2 LOAD VISUALIZER

MEASURES FROM 200 TO 1000 AMPERES WITHOUT CUTTING CONDUCTORS OR INTERRUPTING SERVICE (with split-core transformer). Volts, line amperes, and component amperes are measured directly. Handy calculator is provided for computing power factor, watts, and vars. The AF-2 is self-contained up to 50 amperes, and when used with the Type G-4 spit-core transformer that comes with it, the range can be extended to 1000 amperes.

The load visualizer, split-core transformer, calculator, and terminal leads come in an attractive, sturdy carrying case. Your nearest G.E. Representative will be glad to discuss specific applications with you. See him today. Or write for Bulletin GEC-372. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

*many applications*

**Testing Motors**
**Checking power and lighting circuits**
**Checking transformers**
**Or analyzing *any* a-c load**

*measures*

**Voltage** **Current**
**Power Factor**
**Watts** **Vars**

**GENERAL ELECTRIC**

# "THIS PAIR SAVED ME MONEY ON WIRE...

## THEY GOT IT HERE ON TIME! THEY KNOW THEIR WIRE...

*they're experts!"*

Work crews don't stand idle when this pair is on the job. Orders are quickly delivered.

Prompt delivery is partly the result of having items stocked close to you. Mainly, however, getting you the right product at the right time stems from the teamwork of the U. S. Rubber salesman and the U. S. Distributor's salesman. Together, they make a pair that saves you time, money and worry.

If you run into a supply emergency, or have a tough time finding a hard-to-get item, call your Electrical Distributor or the U. S. Rubber Salesman.

They will also help you coordinate the specifications of architects and engineers, provide engineering and other specialized help relating to products and their applications. For this pair *know* their wire . . . they're experts.

Write today: Electrical Wire and Cable Department, United States Rubber Company, Rockefeller Center, New York 20, N. Y. You'll save yourself money.

**U. S. ELECTRICAL WIRES AND CABLES FOR EVERY PURPOSE**

*The electrical distributor performs an indispensable function in distributing electrical products. He keeps inventories, provides billing, credit and other services—each of which reduces the cost of the electrical product to the contractor.*

MADE BY

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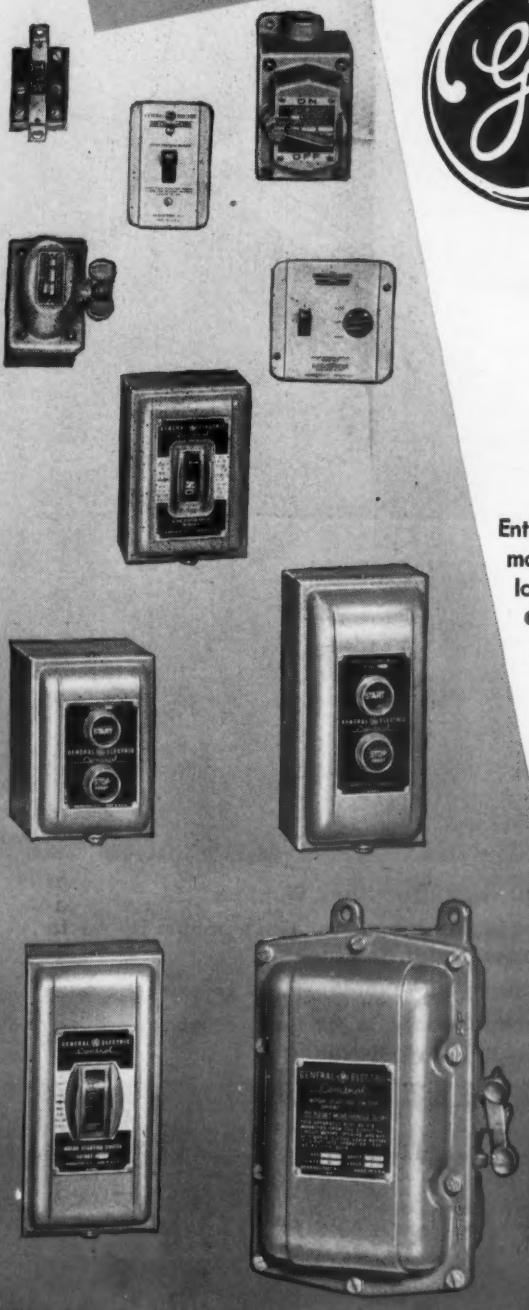
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

# more for your money



# NEW manual motor starters

- **new, improved features**
- **wider selection**

Entire line of G-E manual starters—for fractional up to 7½ horsepower motors—now offers new design features that mean easier installation, longer operation at no increase in price. Here they are:

- A complete new line of pushbutton starters for controlling integral motors. Both pushbutton- and toggle-operated starters are available in the new four-pole form as well as the two- and three-pole forms previously offered.
- Bi-metallic overload protection—formerly found only in expensive equipment—provides quick, positive action, frequent resetting without wear. When relay trips, operating mechanism assumes neutral position, giving positive indication of overload trip.

**All starters provide . . .**

- heavy duty switch mechanism that resists vibration, stands up under frequent use . . . plenty of knockouts, lots of room in the sturdy grey case for wiring . . . dust tight, water tight, and explosion-proof as well as general purpose forms . . . and many other features described in the bulletins.

Whatever your requirements for small-motor starting, you'll find them met in G-E manual starters. Write now—buy now!

GENERAL ELECTRIC

General Electric Company
Apparatus Dept., Section H730-8
Schenectady 5, N. Y.

Please send me: Bulletin GEA-2234E on the CR1061 Manual Starter for F-hp motors.....and (or) Bulletin GEA-1522E on the CR-1062 Manual Starter for Integral Motors.

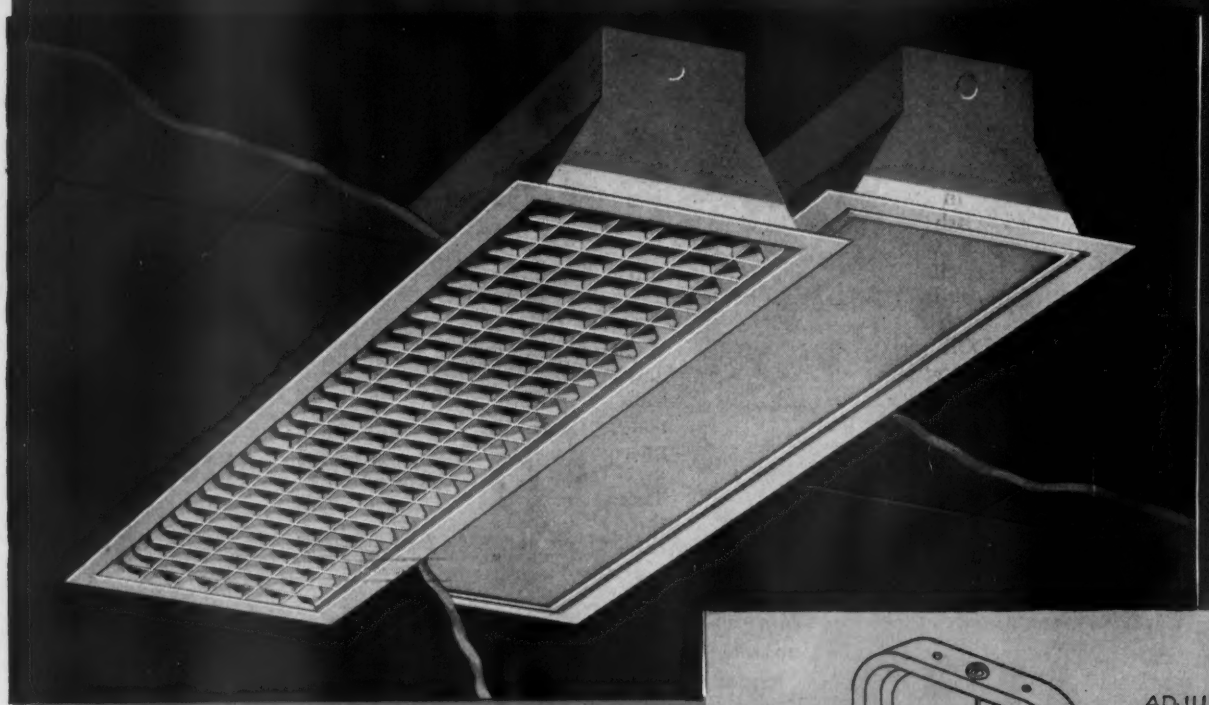
Name.....

Company.....

Address.....

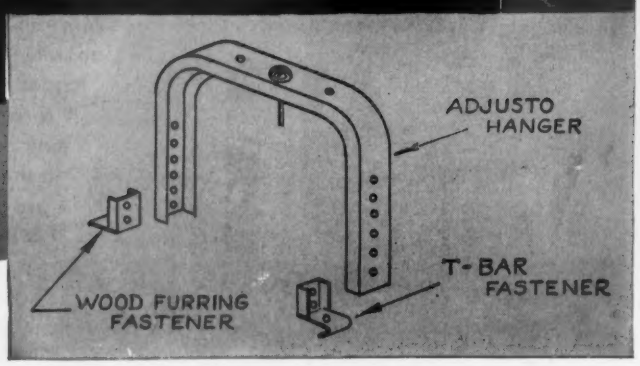
.....

# NOW...*Electro* offers New TROFFERS that are TOPS!



● Louvered type ● Glass type ● Open type

*(Right)* Electro's new "Adjusto Hanger." Specially engineered for easier installation, lower maintenance costs.




## Perfected ELECTRO TROFFERS ...another "ELECTRO-magnet" for new business!

- 20, 30, 40 watt sizes—and Slimline.
- Hinged swinging louvers or glass panels for easier maintenance and installation.
- All units have same dimensional cross section.
- Use interchangeably to fit *any* size room . . . *any* type ceiling . . . *any* type mounting.

ELECTRO'S LIGHTING ENGINEERS ARE ALWAYS AT YOUR SERVICE

## ELECTRO MANUFACTURING CORPORATION

2000 W. Fulton St. • Chicago 12

# here's the COMPLETE LINE of well-known OKONITE TAPES

**First choice for years, of electricians throughout the country, Okonite Tapes provide the superior electrical and physical characteristics necessary to insure splices that are tops in performance and tops in safety. The care and "know-how" that go into the selection of every component, together with Okonite's 71 years of manufacturing experience, guarantee your complete satisfaction with every "all-Okonite" splice.**

**OKONITE Rubber Tape** is made of the finest natural rubber — Up-River Fine Para Rubber. It fuses readily into a homogeneous wall of tough rubber insulation; elastic, resilient, high in dielectric strength and permanently waterproof. Standard ¾" width ½ lb. roll is packed in individual yellow metal cans; other widths in individual cartons.

**MANSON Friction Tape** is made of a closely woven fabric with only new, naturally tacky rubber for greater adhesion. It has high breaking strength, tear-resistance and dielectric strength. Available in black and white. Standard ¾" width, ½ lb. roll of black Manson is packed in individual white metal cans; other widths also available.

**OKONITE Rubber and MANSON Friction Tapes FOR TOP-QUALITY SPLICES**

**Electrical men, who know it is false economy to use poor splicing materials with fine cables, demand the best. For 60 years they have been selecting Okonite and Manson Tapes for every splicing job.**

**PANTHER and DRAGON Friction and Rubber Tapes FOR GOOD SPLICES AND GENERAL REPAIRS**

**Highly successful for all-around electrical splices and repairs, PANTHER and DRAGON Tapes pass all ASTM and Federal Specifications. Individually cellophane-wrapped and sealed, these tapes remain fresh for immediate and future use. The new, attractively designed packages promote sales.**

**PANTHER and DRAGON Friction Tapes** have proved themselves in adhesive qualities and breaking strength because they are made to stay "alive" longer.

**PANTHER and DRAGON Rubber Tapes** fuse readily and permanently; have ample stretchability and high dielectric strength.

**PANTHER Service Pack** holds 10 rolls of No. 8 PANTHER Friction Tape only, 5 lbs. gross. Each roll wrapped and sealed individually.

**PANTHER Handy Package** holds 10 individually wrapped and sealed rolls of friction or rubber tape in No. 8, 5-lb. and No. 4, 2½-lb. gross sizes for counter or shelf.

**PANTHER Friction Tape Display Cartons** are packed with tape rolls sealed in cellophane and individual boxes . . . attracting customers to your counter. The No. 1 tape Display Carton holds 32 rolls while the No. 2 tape carton holds 16 rolls.

**TAPE DIMENSIONS**

| Roll No. | Length (Feet) |
|---|---|
| **PANTHER FRICTION** | |
| No. 8 | 60 |
| 4 | 30 |
| 2 | 13 |
| 1 | 5 |
| **PANTHER RUBBER*** | |
| No. 8 | 23 |
| 4 | 11½ |
| **DRAGON SPECIFICATION* FRICTION** | |
| No. 8 | 82½ |
| 4 | 41½ |
| **DRAGON SPECIFICATION* RUBBER** | |
| No. 8 | 30 |
| 4 | 15 |

*Standard width ¾". Other widths made to order only.

7621

**THE OKONITE COMPANY**

PASSAIC — OKONITE SINCE 1878 — NEW JERSEY

# ALLIS-CHALMERS ANNOUNCES

# NEW High Voltage Air Contactor

★ *Cuts Space Requirements*

★ *Increases Contact Life... Reduces Maintenance*

★ *Now Available in High Voltage Starters*

FOR THE FIRST TIME a high voltage air contactor of approximately the same size as an oil immersed contactor is now available. Measuring only 15 x 25 x 38 inches, the Type 256 Contactor combines double break contacts, dual blowouts and special arc chambers to permit its space-saving design. The magnet and movable contacts operate with a straight line motion in the vertical plane eliminating the need for turning shafts, shaft bearings and flexible leads. Fewer parts mean longer life — less maintenance.

*You get increased contact life!* Double break contacts cut arc voltage in half. Integral arc runners remove the arc simultaneously with contact separation. Movable contacts are self-centering. Inserts of arc resistant alloy assure clean contact surfaces . . . These are points that add up to extra long contact life — more dependable start-stop service on your job.

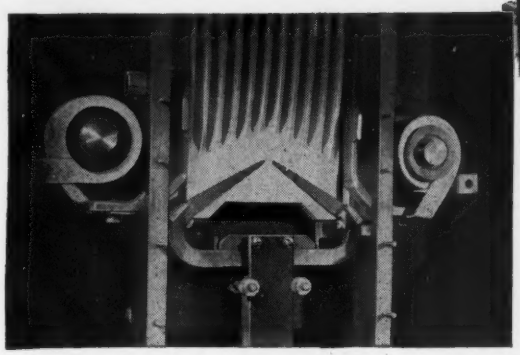
The Allis-Chalmers line of High Voltage Starters has been expanded to include the use of Type 256 Contactors as well as oil contactors.

A-C ALLIS-CHALMERS

**ALLIS-**

**SPACE SAVING** Features that result in space saving include: special arc chambers; double break contacts; dual blowout structure; and vertical action.

**SPECIAL ARC CHAMBER** The arc chute is designed to take fullest advantage of the dual blowouts. Interleaving fins and dividers lengthen the arc in both horizontal and vertical planes.



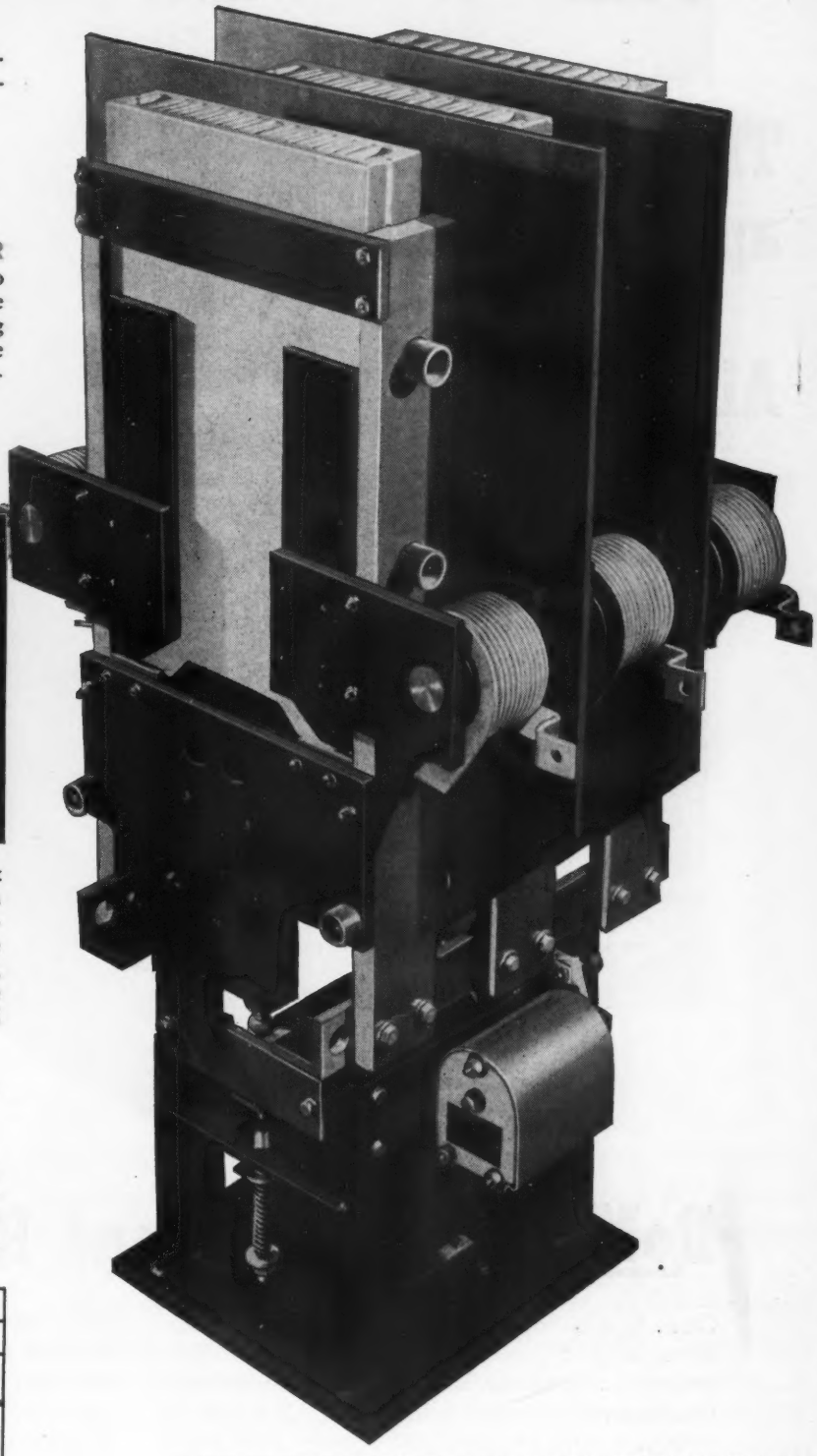
**DUAL BLOWOUT STRUCTURE** Each contact break is provided with a continuous duty blowout coil, an arc horn and an arc runner. At low currents this arrangement acts to snuff out quickly the two separate arcs before entering the arc chutes. At higher currents, the two arcs are propelled rapidly until they join. The single arc thus formed is extinguished in the special arc chute.

**DOUBLE BREAK CONTACTS** eliminate flexible leads, turning shafts and shaft bearings.

**PLUS THESE EXTRA FEATURES** Movable contacts are self-aligning and have pressure adjustments to assure positive anti-bounce closing of both gaps. These are features that add up to dependable service, long contact life and low maintenance.

| Poles | Ampere Rating Continuous Duty (8 Hr. Basis)* | Max. Volts | Maximum Horsepower | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2300-2300 Volts | | | 4000-4600 Volts | | |
| | | | Synchronous | | Induction | Synchronous | | Induction |
| | | | 1.0 P.F. | 0.8 P.F. | | 1.0 P.F. | 0.8 P.F. | |
| 3 | 200 | 2300 | 900 | 700 | 700 | ..... | ..... | ..... |
| 3 | 400 | 2300 | 1750 | 1300 | 1500 | ..... | ..... | ..... |
| 3 | 200 | 5000 | ..... | ..... | ..... | 1500 | 1250 | 1250 |

Yes, Allis-Chalmers Type 256 Contactor is available arranged for reversing and dynamic braking. Utilize the advantages of this new completely tested air contactor in new controls or as a replacement device. Send the coupon now or call your A-C Sales Office.



# CHALMERS

ALLIS-CHALMERS, 930A SO. 70 ST.
MILWAUKEE, WIS.

Gentlemen:

Please send advance information on the New Type 256 High Voltage Air Contactor.

Name _____

Title _____

Company _____

Address _____

City _____ State _____

A-2841

# The C A A approved cables for Airport Wiring

Single and multiple conductor for 600, 3000 and 5000 volt service. Write for descriptive specifications RR-1 and RO-4.

## RoMarine - RoPrene and RoZone - RoPrene

Close to a billion dollars will be spent on a national airport building and improvement program . . . a whale of a market for electrical wholesalers and contractors. When it comes to airport wiring be sure you specify RoMarine-RoPrene or RoZone-RoPrene. These Rome cables are the first to be approved by the Civil Aeronautics Administration for airport lighting and control circuits.

RoMarine-RoPrene is approved as Type A—Style RR for 600, 3000 and 5000 volts. RoZone-RoPrene is approved as Type B—Style ROR for 3000 and 5000 volt service. The approval covers single and multiple conductor constructions in all sizes described by Specification L-824.

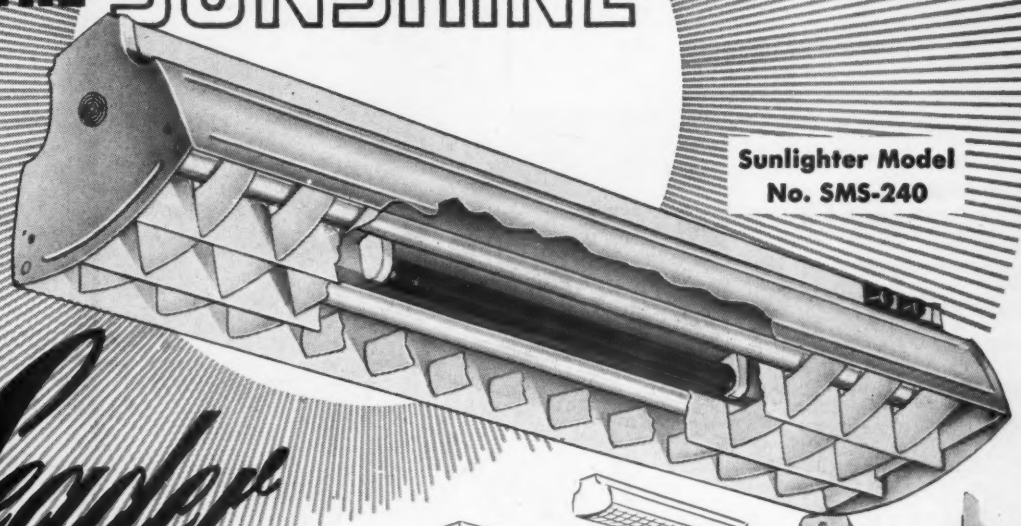
In being the first cable manufacturer to receive CAA approval, Rome Cable is well prepared to take care of your requirements promptly. Contact your nearest Rome Cable office for price and delivery.

*It costs less to buy the best . . . buy Rome Cable*

ROME CABLE Corporation
ROME · NEW YORK
From Bar to Finished Wire

ROME CABLE ROME, N.Y.

# TURN ON THE SUNSHINE



Sunlighter Model
No. SMS-240

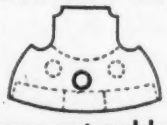
## The NEW Leader SUNLIGHTER

*(First successful sun-ray reproduction over large areas)*

**Excellently suited for use in CLASSROOMS GYMNASIUMS · ASSEMBLY HALLS · HOSPITALS SANITARIUMS · OFFICES FACTORIES · BOWLING ALLEYS**

At last, a reproduction of the sun's most desirable ultra-violet rays—the rays that tan the skin to a robust tone, produce Vitamin D; help in the deposition of calcium for sounder teeth and more rugged bones, to cure and/or to ward off rickets; *all* the benefits to health of the sun's ultra-violet rays.

**A 3-lamp ensemble**



**STAYS COOL**

with the sun-lamp centered between lighting lamps. Length of lamps gives effectiveness over large area . . . Available in 64", 72" and 96" LEADER Slimline models. Also in LEADER SM-240 (4 ft.) and SM-2-100 (5 ft.) . . . 40/60 LIGHT DIFFUSION—plus sun-rays . . . Complete specifications upon request.

***LEADER leads again!***
***IMMEDIATE DELIVERY on this revolutionary fixture!***

**Not a theory for the future but an actuality for immediate delivery: LEADER'S SUNLIGHTER—a 2-in-1 fluorescent fixture of quality illumination and a successful duplication of sunlight's ultra-violet rays.**

**Here is a sun-lamp fixture that eliminates the faults of previous sun-lamps. The first ultra-violet radiations similar to sunlight: 2800-to-3200 Angstrom band . . . a continuous band concentrated in the most biologically effective spectral region . . . produces Vitamin D in very substantial quantities . . . (Undesirable wave-lengths are blocked out . . . lamp stays cool to the touch during use!)**

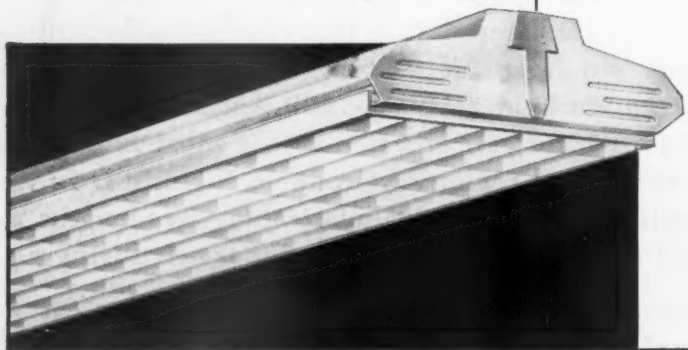
***Sold and installed only by the better electrical wholesalers and contractors***

**LEADER ELECTRIC COMPANY**
3500 North Kedzie Avenue, Chicago 18, Ill.
West Coast Factory: 2040 Livingston, Oakland 6, Cal.

**. . . at WENDER & ROBERTS Inc.**
**Atlanta, Georgia**

Engineer: Harry Yopp, Georgia Power Company
Contractor: O. V. Scott Electric Company
Lighting Equipment: 34 Litecontrol No. 4044 louvered, 4-lamp fixtures, plus perimeter lighting, incandescent spotlights and showcase lights
Lamps: 40 watt, 3500° white
Footcandles: 75 in service (average)

Whether your clients are interested in selling more goods or in increasing visual efficiency, you'll find it will pay to prescribe Litecontrol fixtures. In this wide line, there are sturdy, graceful units that smoothly blend with any architectural design. All are extra-sturdy in construction, easy to install, built to give your clients more years of ample, glareless light with minimum maintenance. Write today — we'll be glad to help you by supplying complete lighting layouts.



**. . . with LITECONTROL NO. 4044 FIXTURE**

Offering full light distribution with low surface brightness, this fine Litecontrol unit is also distinguished by unusually low installation and maintenance costs. Hinged louvers swing down for easy lamp replacement and cleaning.

| Cat. No. | No. of Lamps | Length | Width | Height | Approx. Ship. Weight |
|---|---|---|---|---|---|
| 4044 | 4-40W | 49" | 16" | 5¼" | 44 lbs. |
| 4000-20 Downlight reflectors | | | | | 6 lbs. |

LITECONTROL CORPORATION
36 PLEASANT STREET, WATERTOWN 72, MASSACHUSETTS

LITECONTROL
*Fixtures*
KEEP UPKEEP DOWN

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

# RACO is a 3-way winner!

**The RACO Line has won the wholehearted acceptance of Contractors—**
**It's won the confidence of Architects—**
**It's won the enthusiastic support of Jobbers and Wholesalers!**

Championship of products in the building trades, however, has to be well earned. RACO's complete line of switch and outlet boxes has earned its top position on many counts—contractors depend upon the workmanship, quality, and careful inspection of RACO Boxes to insure quick installation. Architects know that RACO Boxes are dependable. The wide acceptance of the RACO Line assures wholesalers of quick turnover and steady demand. The RACO Line is approved by the Underwriters' Laboratories, Inc.

## You can always rely on RACO!

**RACO**

**ALL-STEEL PRODUCTS**

**ALL-STEEL EQUIPMENT Inc.**—800 Kensington Ave., Aurora, Illinois

*"A BOX FOR EVERY NEED"*

# Get your Free INDENTER

Cross Section Showing Indentations.

**Here is your chance to get a free Briegel Indenter — the tool that saves more time installing thin wall tubing than anything else on the market. This Special Package Offer is made up of 400 1/2" Briegel Connectors and 200 1/2" Briegel Couplings — enough to wire three average six room houses — and One Original Briegel Indenter all for the price of the fittings alone.**

**The Briegel Method of installing thin wall is not only faster and less expensive but also neater in appearance and more permanent.**

**Cash in on this free offer while it lasts. Save time and save money on your original purchase and on the job with Briegel Fittings!**

**This offer available at all leading wholesalers.**

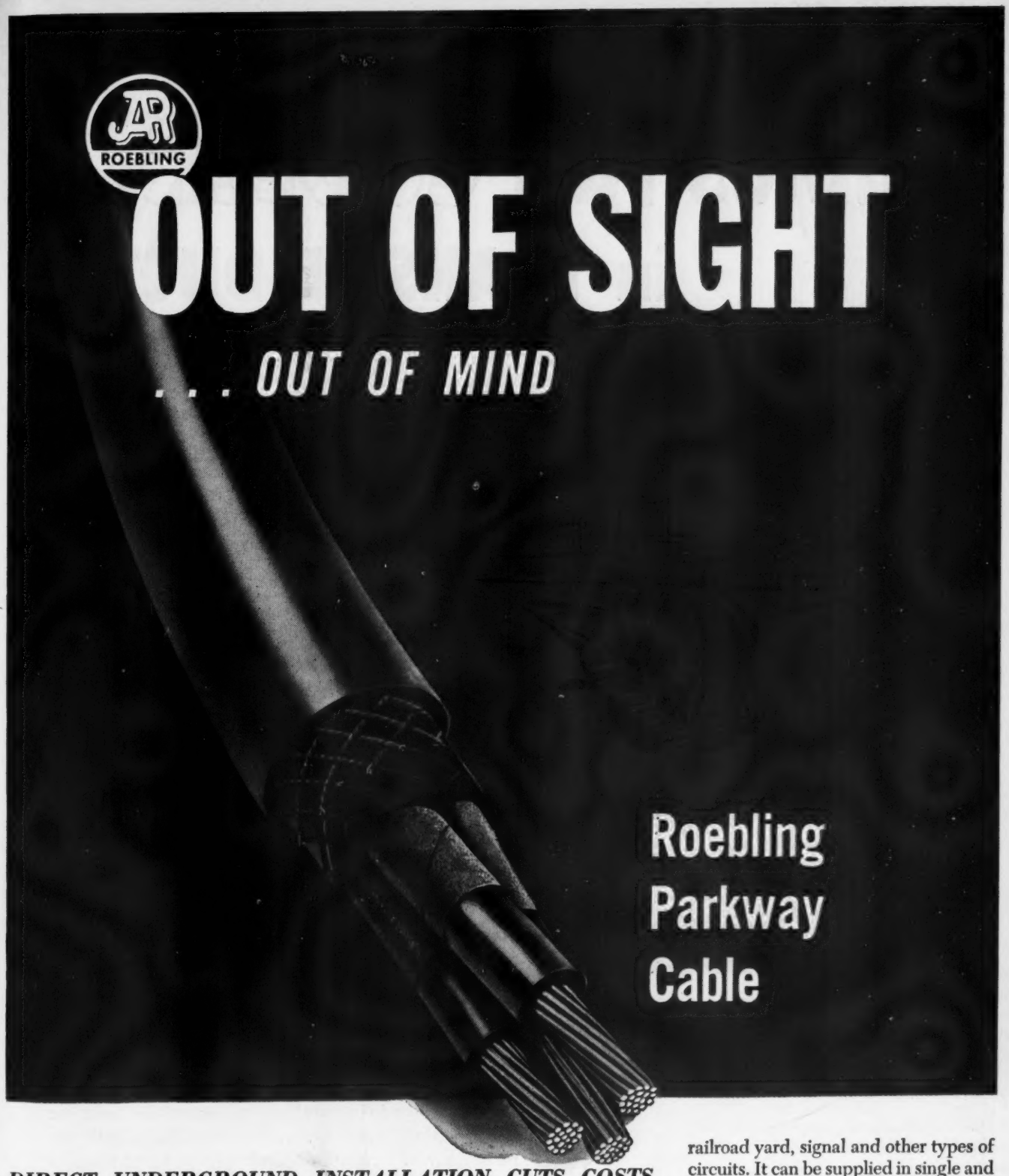
**All B-M Fittings Carry the Underwriters' Seal of Approval**

***This offer subject to withdrawal without notice***

Insist on Briegel All-Steel Approved Couplings and Connectors. These are the Original Labor-Saving Indenter Type Fittings used by contractors for over 15 years.

# BRIEGEL METHOD TOOL CO.

GALVA • ILLINOIS




## *DIRECT UNDERGROUND INSTALLATION CUTS COSTS*

YOU AVOID ALL THE EXPENSE of underground duct systems with Roebling Parkway Cable. It's laid directly in an economical two- or three-foot trench. And as soon as it's out of sight, your problems are over. Wind and weather can't bring service troubles . . . metallic armor or a non-metallic Roeprene sheath assures safe physical protection.

Roebling Parkway Cable is being widely adopted for series street lighting, parkway boulevard lighting, traffic signal, fire alarm, flood lighting, railroad yard, signal and other types of circuits. It can be supplied in single and multiple conductor types—either solid or stranded—in a range from 600 to 5000 volts.

Have your Roebling distributor or Roebling branch office help select the best cable for your special needs. John A. Roebling's Sons Company, Trenton 2, New Jersey.

*WRITE OR CALL THE ROEBLING FIELD MAN AT YOUR NEAREST ROEBLING OFFICE AND WAREHOUSE*

*Atlanta*, 934 Avon Ave. ★ *Boston*, 51 Sleeper St. ★ *Chicago*, 5525 W. Roosevelt Rd. ★ *Cleveland*, 701 St. Clair Ave., N. E. ★ *Denver*, 1635 17th St. ★ *Houston*, 6216 Navigation Blvd. ★ *Los Angeles*, 216 S. Alameda St. ★ *New York*, 19 Rector St. ★ *Philadelphia*, 12 S. 12th St. ★ *Pittsburgh*, 855 W. North Ave. ★ *Portland, Ore.*, 1032 N. W. 14th Ave. ★ *San Francisco*, 1740 17th St. ★ *Seattle*, 900 First Ave.

**ROEBLING**

☆ *A CENTURY OF CONFIDENCE* ☆

# Cables run COOLER...
## in TRANSITE DUCTS

**. . . reducing copper losses**

**. . . increasing current capacity**

**. . . prolonging insulation life**

HERE'S HOW to reduce copper losses . . . increase current carrying capacity . . . and prolong insulation life—run your cables in Transite* Ducts.

Current carrying capacities can be increased in a typical duct bank as much as 5%, or $I^2R$ losses can be reduced 11%, for cables located in Transite as compared with other ducts used for power circuits.

And, Transite Ducts assure permanent duct banks because Transite is incombustible; is immune to rust and rot; is unaffected by electrolysis; will not slag under action of an arc, and will retain its high original strength.

An unusually smooth bore assures no injury to cable sheath, either in natural movement under load, or when pulling-in cables. Long, lightweight lengths can be quickly and economically installed. In addition, a full line of fittings simplifies even the most complicated of installations.

For full information on Transite Ducts, write for Data Book DS-410. Johns-Manville, Box 290, New York 16, N. Y.

*Reg. U. S. Pat. Off.

**How Transite Ducts increase current carrying capacities**

Type cable 3 cdr. 500 MCM Compack Sector, 15 KV (6th Edition AEIC Spec.)
No. of cables—3 (all loaded in one bank)
Daily Load Factor—75%

| Earth Temp. ambient—20 C | Transite | Other |
|---|---|---|
| Total Therm. Res. to Dielectric Loss (C watts/ft.) | 5.66 | 6.17 |
| Total Therm. Res. to Copper Loss (C watts/ft.) | 4.44 | 4.95 |
| Temp. Rise from Dielectric Loss (C) | 1.9 | 2.1 |
| Allowable Rise for Copper Loss (C) | 59.1 | 58.9 |
| Allowable Watts per ft. cable | 4.44 | 3.96 |
| Allowable Current—(Amps. per cdr.) | 386. | 365. |
| Allowable Current—(Relative %) | 105.6 | 100. |

**Johns-Manville** *Transite Ducts* **"KORDUCT"— for encasement in concrete**

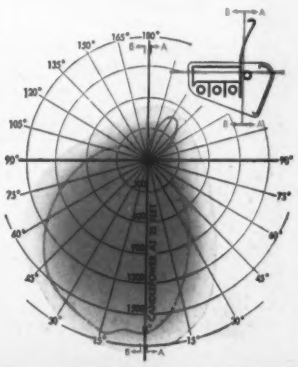
**"CONDUIT"— for use exposed and underground without encasement**

VAL-LITE

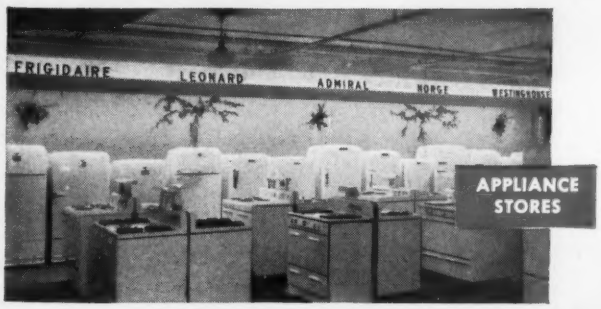
# *Four prime prospects for*

# KENT-MOORE VAL-LITES

NEXT time you're planning a commercial lighting system, tell your customers about new Kent-Moore VAL-LITES. They're "naturals" for modern merchandising . . . in service stations, appliance stores, super markets, automobile dealerships, and many other types of retail store installations. For VAL-LITES, you see, do more than provide diffused illumination around the wall sales area. They're designed to dramatize merchandise, create attractively lighted, "buy-appealing" displays. They permit effective point-of-purchase advertising, and department identification, too, with easy-to-change individual letters that stand out sharply against a glow of fluorescent back-lighting. And experience has shown that, wherever VAL-LITES go in, retail sales go up!



**Candlepower Distribution Chart for four lamp VAL-LITE fixture.**



**VAL-LITES** . . . Quickly, easily installed. Sturdily built, union made, approved by Underwriters'. Available in models for two or four 40-watt fluorescent lamps. Send coupon today for new VAL-LITE Merchandising Manual containing complete specifications and installation data.

## Kent-Moore
**ORGANIZATION, INC.**

GENERAL MOTORS BUILDING • DETROIT 2, MICHIGAN

**Lighting Division** (C)
**Kent-Moore Organization, Inc.**
**General Motors Bldg. • Detroit 2, Mich.**

**Gentlemen:**
Without obligation, please send me your new VAL-LITE Merchandising Manual.

Name_____
Company_____
Street and No._____
City_____ Zone____ State_____

# A Permaflector Lighting Portrait

GIMBELS PITTSBURGH

William York Cocken Architect
The Trimble Co. General Contractors
C. W. Carter Elec. Construction Co.
Electrical Contractor

Here, in Gimbels newly designed first floor, fluorescent and incandescent silvered-glass Permaflectors produce "light for selling." Dramatic yet functional illumination is achieved with the 203 combination, ceiling recessed, fluorescent-incandescent units.

To transfer your creative lighting designs from "blueprint" to reality is relatively simple when you specify Pittsburgh Permaflector Lighting Equipment. Pittsburgh Reflector Company has the equipment and know-how required to give you efficient, economical illumination that exactly fills your needs—whether your plans call for fluorescent or incandescent light or a combination of both. You will find it worthwhile to discuss your problems with Pittsburgh Permaflector Engineers. Why not call or write today?

## PITTSBURGH REFLECTOR COMPANY

**404 OLIVER BUILDING • PITTSBURGH 22, PENNSYLVANIA**

**MANUFACTURERS OF FLUORESCENT & INCANDESCENT LIGHTING EQUIPMENT**

**Permaflector Lighting Engineers in All Principal Cities**

"Pittsburgh" Permaflector

PITTSBURGH PERMAFLECTOR LIGHTING EQUIPMENT IS DISTRIBUTED BY BETTER ELECTRICAL WHOLESALERS EVERYWHERE

# TRIANGLE'S NEWLY EXPANDED CONDUIT PLANT

Triangle Rigid Steel Conduit finish is hot dip galvanized, uniformly both inside and outside, with additional protection assured by a baked-on coat of specially prepared linseed oil base lacquer. Available in sizes from ½ to 6 inches, with couplings and elbows to fit.

Triangle Electric Metallic Thin Wall Conduit is welded from high grade steel strip, insuring a perfectly true tube of uniform thickness and strength. Hot dip galvanized uniformly both inside as well as outside. Threadless. Available in ½ through 2 inch sizes.

Now your requirements for rigid steel and thin wall conduit can be met faster, more dependably, since Triangle's newly expanded plant is in production. Located in Moundsville, W. Va., hard by the steel center of Wheeling, this enlarged manufacturing establishment incorporates latest advancements in production equipment to assure greater output and the uniformly high quality for which Triangle has been famous for over 30 years.

Particularly important is the exceptional degree of uniformity in the hot-dipped galvanizing, both inside and outside, of Triangle conduit. Where conditions are *really* severe — in refineries, around industrial plants, on bridges over salt water — more and more critical users are insisting on Triangle rigid steel and thin wall conduit.

**For *Extra* quality — at NO extra cost — insist on TRIANGLE!**

# NOW SERVES YOU Better, Faster!

*If It Bears This Trade Mark* *It's Made by Triangle . . .*

*If It's Made by Triangle IT MUST BE RIGHT!*

For latest information on deliveries, contact your nearest Triangle distributor or representative, or write

**TRIANGLE CONDUIT & CABLE CO., INC.**

**1908 Jersey Avenue, New Brunswick, N. J.**

ARTERIES FOR ELECTRICAL SYSTEMS — INCORPORATED — IT MUST BE RIGHT!

BUILDING WIRE • BARE WIRE • ARMORED CABLE • "GLAZON" TRIEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE, SERVICE DROP, VARNISHED CAMBRIC BRAIDED OR LEADED, TRIOPRENE TRENCH, POWER AND PARKWAY CABLES RIGID CONDUIT • ELECTRIC METALLIC THIN WALL CONDUIT • FLEXIBLE STEEL CONDUIT

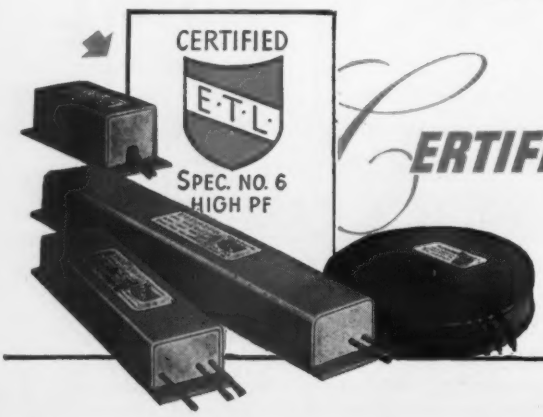
# Certified Ballasts = Dependable Lighting Performance

• You can be sure of long, dependable service from fluorescent fixtures by insisting on Certified Ballasts in the equipment.

**Certified Ballasts deliver... Full lamp life**
**Rated light output**
**Dependable performance**

The reason for this is: Certified Ballasts are made to precise specifications ... specifications which conform to the exact requirements of fluorescent lamps ... then tested, checked and certified by impartial Electrical Testing Laboratories, Inc.

***All Fleur-O-Lier fixtures use Certified Ballasts.***




## CERTIFIED BALLAST MANUFACTURERS

*Makers of Certified Ballasts for Fluorescent Lighting*

**2116 KEITH BLDG., CLEVELAND 15, OHIO**

# NOW READY FOR YOU....

## THE NEW

# "Job Size Roll"

## REG. U. S. PAT. OFF. SCOTCH BRAND No. 33 Electrical Tape

Twelve "Job Size" twenty-foot rolls of "SCOTCH" No. 33 Electrical Tape in a strong neat tube — each roll a convenient one day supply. Your electricians will like it because the new twenty-foot roll is easy to use and easy to carry; YOU will like it because its neat compact tubes take up little storage room and give the tape perfect protection while in stock. The twenty-foot roll is an average day's supply for an electrician with a steady schedule of wiring assignments.

Order from your jobber today and enjoy the convenience and economy of "SCOTCH" No. 33 Electrical Tape in the "Job Size" Roll.

Made in U. S. A. by
**MINNESOTA MINING & MFG. CO.**
St. Paul 6, Minnesota
also makers of other
"SCOTCH" Brand Pressure-Sensitive Tapes, "UNDERSEAL" Rubberized Coating, "SCOTCHLITE" Reflective Sheeting, "SAFETY-WALK" Non-Slip Surfacing, "3M" Abrasives, "3M" Adhesives.

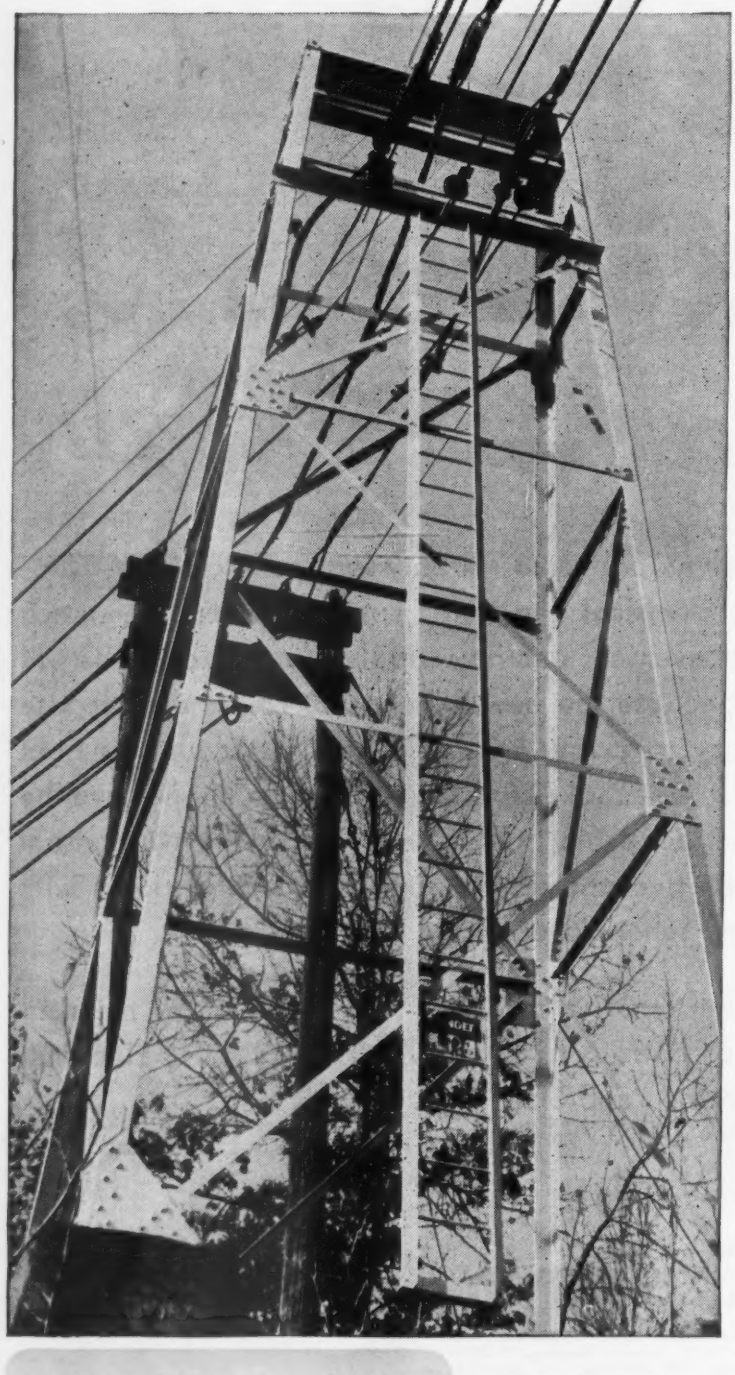
ANOTHER 3M COMPANY PRODUCT

REG. U. S. PAT. OFF. SCOTCH BRAND No. 33 Electrical Tape

*General Export:* DUREX ABRASIVES CORP., *New Rochelle, N. Y.*
*In Canada:* CANADIAN DUREX ABRASIVES LTD., *Brantford, Ontario*

# MORE DATA ON ALCOA EC ALUMINUM

Lighter weight, lower cost . . . on the job today



**Q** ***How does ALUMINUM compare on tensile and breaking strength?***

***Tensile strength of ALUMINUM conductor is higher than copper wire for comparable duty.***

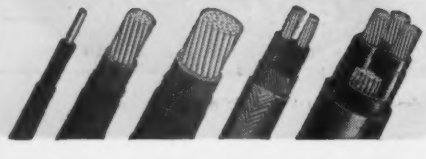
Insulated wire and cable made with Alcoa E.C.* Aluminum is specified two AWG sizes larger than copper if same voltage drop or power loss is desired. If specified for same carrying capacity (temperature rise) the aluminum conductor has approximately 36% larger cross section than copper. In both cases, the aluminum conductor is stronger. And the ratio of strength to weight is much greater. For example, aluminum can sustain at least twice the length of vertical riser permissible with copper conductors.

You get greater tensile breaking strength—you get lighter weight and lower costs—with wire and cable made with Alcoa E. C. Aluminum. Alcoa makes light, strong, conductive E. C. Aluminum; leading wire manufacturers draw, strand and insulate it, and sell it under their own trade marks. Ask your wire supplier about it, or write ALUMINUM COMPANY OF AMERICA, 2197K Gulf Building, Pittsburgh 19, Pennsylvania. *E. C.: *Electrical Conductor* Aluminum

← MOSINEE PAPER COMPANY

1,500,000 cm T.B.W.P. all-aluminum cable river-crossing span 800 ft. long. Three aluminum cables, two iron shield wires above and an additional circuit of 400,000 cm copper underneath. Installed in 1914. Carries load up to 1000 amperes. A double circuit of 400,000 cm copper is paralleled and connected to the 1,500,000 cm aluminum cable by use of aluminum parallel groove clamps. Clamps are bare and have not been changed since installation in 1914.

Insulated and sold by leading wire manufacturers



ALCOA E.C. ALUMINUM

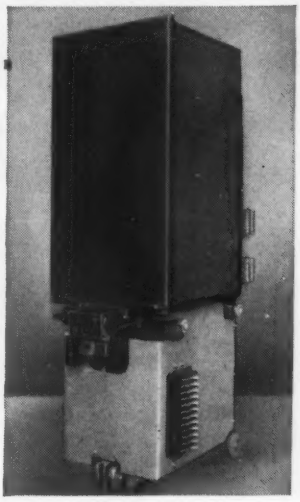
FOR ELECTRIC WIRE AND CABLE

# Are You *Really* Interested in Getting More for Your Money?

➡ For years, I-T-E has maintained leadership in the circuit breaker and switchgear industry. Today, I-T-E invites you to look over the special built-in features which have become a part of its "standard price" switchgear . . .

*PLANNED FOR BETTER*
**ACCESSIBILITY**

*PLANNED FOR EASIER*
**HANDLING**



*PLANNED FOR GREATER*
**SAFETY**

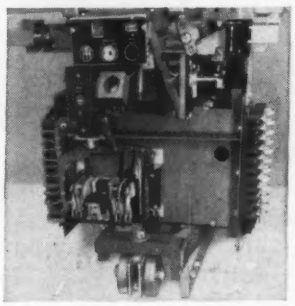
**METERS AND RELAYS** are mounted on a *Relay Panel* designed for that specific purpose. Why?

a. Delicate relay mechanisms are not subjected to "operation by vibration" when circuit breaker doors are opened or closed or bumped.

b. The Relay Compartment is just that. The secondary wiring, control bus, and relays are together, *where you want them*, not where manufacturing economy dictates.

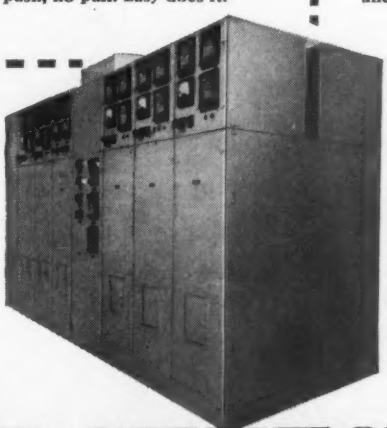
**TESTING CIRCUIT BREAKER** operation within the structure is no longer a chore.

a. Release a catch, move the breaker 4½ inches, and you are ready to test. An electrical close-trip test-switch is furnished on every breaker unit. Test control circuits are automatically set up. No jumpers, no plugs, no push, no pull. Easy does it!



**HIGH IMPULSE CIRCUIT BREAKERS**

If you are impulse conscious you are familiar with the present interim test that permits circuit breakers of the 5KV class to be subjected to a 45KV impulse test across the open contacts. Type HV breakers are tested to withstand a 60KV impulse — phase to phase, phase to ground, and across the open contacts.



**COORDINATED IN MULTUMITE BOARDS**

I-T-E HV MULTUMITE Switchgear assemblies coordinate efficient I-T-E HV Air Circuit Breakers with transformers, meters, bus, and instruments into a single, efficient unit. I-T-E HV Air Circuit Breakers are rated at 5KV, 7.5KV, and 15KV — 600 A., 1200 A., and 2000 A. continuous; 50MVA, 150MVA, and 250MVA interrupting

**These are but a few of our better points. There is an I-T-E Field Application Engineer in your area. Permit him to tell you of other advantages, and to assist in your switchgear planning.**

# POWER SWITCHGEAR

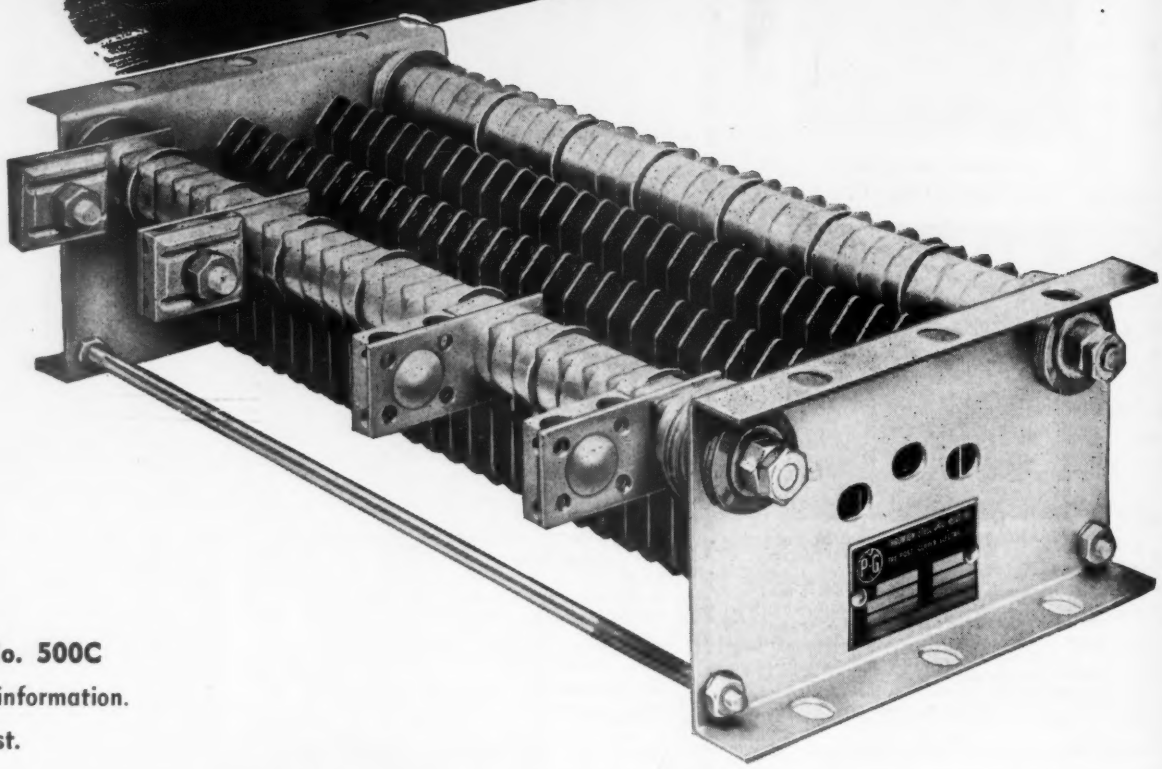
**I-T-E CIRCUIT BREAKER COMPANY, 19th & Hamilton Streets, Philadelphia 30, Pa.**
**31 Offices in United States • In Canada, EASTERN POWER DEVICES, Ltd., TORONTO**
**For Export: Philips Export Corp., New York**

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • POWER CIRCUIT BREAKERS
MECHANICAL RECTIFIERS • RESISTORS • SPECIAL PRODUCTS

* *For power switching equipment refer to Railway & Industrial Engineering, an I-T-E organization*

P-G

# *Steel Grid Resistors* HELP KEEP EQUIPMENT IN *Continuous* OPERATION



**BULLETIN No. 500C**
Gives detailed information.
Copy on request.

P-G nonbreakable steel construction and mica insulation, with provision for expansion enables P-G Steel Grid Resistors to withstand many factors responsible for resistor failure. By reducing failures and thus minimizing hours lost in electrical repair and maintenance, P-G Resistors will do their part to keep your production equipment in continuous operation.

P-G

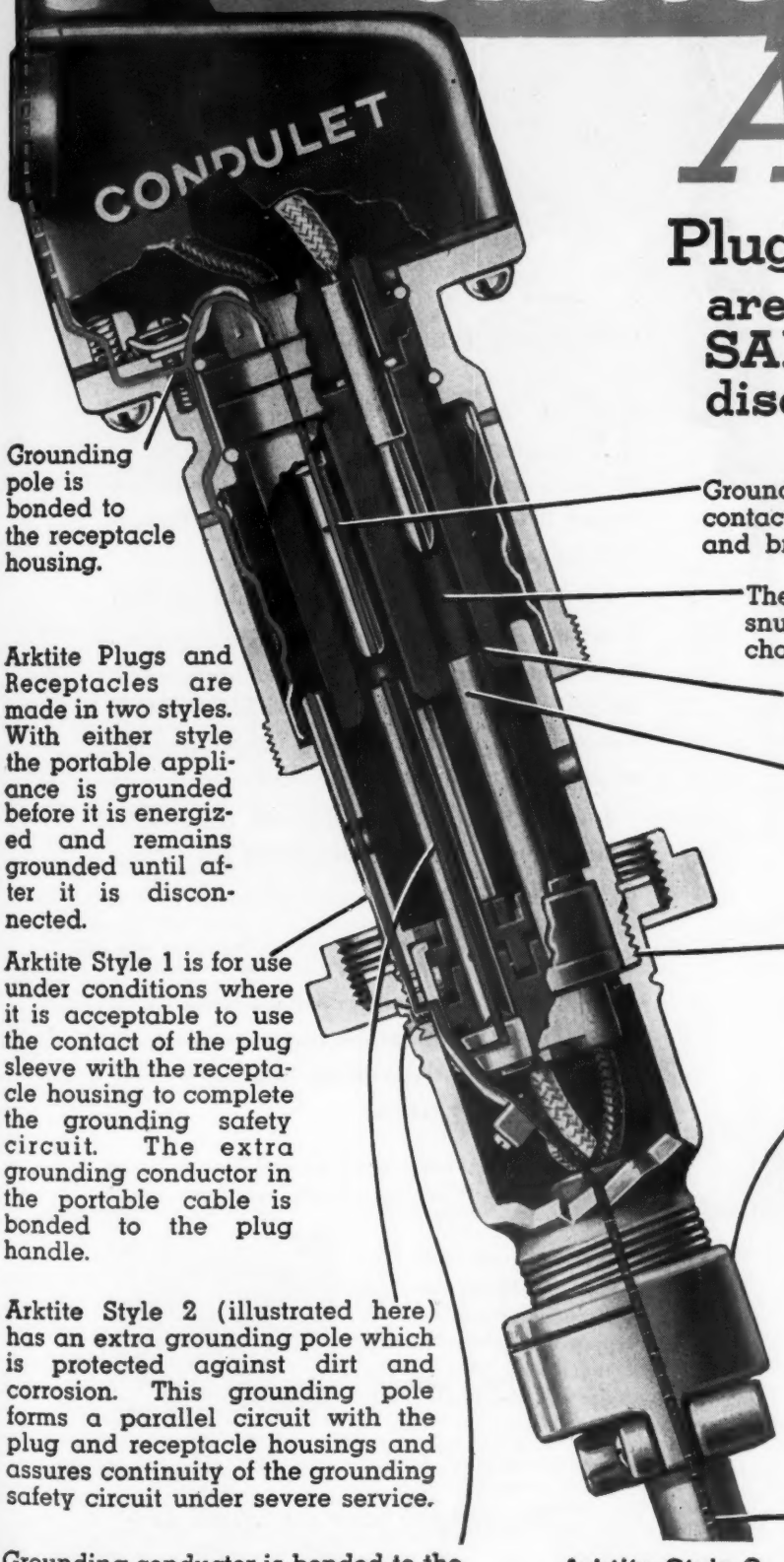
*The Nonbreakable Steel Grid Resistor*

THE POST-GLOVER ELECTRIC COMPANY
• ESTABLISHED 1892 •
221 WEST THIRD STREET, CINCINNATI 2, OHIO

# CROUSE-HINDS

# Arktite

## Plugs and Receptacles are circuit breaking and SAFE without additional disconnect equipment.




Grounding pole is bonded to the receptacle housing.

Arktite Plugs and Receptacles are made in two styles. With either style the portable appliance is grounded before it is energized and remains grounded until after it is disconnected.

Arktite Style 1 is for use under conditions where it is acceptable to use the contact of the plug sleeve with the receptacle housing to complete the grounding safety circuit. The extra grounding conductor in the portable cable is bonded to the plug handle.

Arktite Style 2 (illustrated here) has an extra grounding pole which is protected against dirt and corrosion. This grounding pole forms a parallel circuit with the plug and receptacle housings and assures continuity of the grounding safety circuit under severe service.

Grounding conductor is bonded to the plug handle.

Grounding pole is longer than the others so contact in the grounding circuit is made first and broken last.

The arc formed by pulling the plug is instantly snuffed in the confined insulated arcing chamber.

Each plug contact fits closely the opening of its individual arcing chamber.

The arc is broken while the plug contact is still a considerable distance inside of the arcing chamber. There is no danger of the arc traveling over to the other side of the circuit or to the housing.

Two-piece plug is easy to take apart and reassemble.

Direct-pressure clamp insures positive grip on the conductor cable.

**Arktite Style 2. Sectional View**

The green line indicates the grounding safety circuit.

**CROUSE-HINDS offers the only complete line of circuit breaking plugs and receptacles—20 Amp. to 400 Amp., 250 volt D.C., 600 volt A.C.**

Complete listings are in the Condulet Catalog.

A Nationwide Distribution Through Electrical Wholesalers

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Offices: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Indianapolis — Kansas City — Los Angeles — Milwaukee — Minneapolis — New York — Philadelphia Pittsburgh — Portland, Ore. — San Francisco — Seattle — St. Louis — Washington. *Resident Representatives:* Albany — Atlanta — Baltimore — Charlotte — New Orleans — Richmond, Va. — Salt Lake City
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**CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS**

# General Electric brings you a new, bigger slimline fluorescent lamp!

*Two great sales makers—General Electric's 96" slimline lamps:*
*T-8 (1" dia.)*
*New T-12 (1½" dia.)*

***. . . gives modern streamlined lighting with low maintenance cost, long life.***

HERE it is! A big new slimline fluorescent lamp . . . 8 feet long, 1½ inches in diameter . . . 75 watts, and it has a greater light output than any other General Electric fluorescent lamp.

It's the new General Electric T-12 slimline.

When you're designing cool, modern streamlined lighting for stores, offices, factories, better investigate the sales-making possibilities of G-E slimlines and particularly this newest member of the slimline family . . . the T-12.

In addition to its size, this new lamp offers your customers all these important advantages of G-E slimline lamps:

SLIMLINE FLUORESCENT LAMPS

1. **Easy maintenance. Single-pin base makes it easy to install and replace.**
2. **New streamlined appearance.**
3. **Instant start—no starters needed.**
4. **High efficiency—more light per watt.**
5. **Long life.**

For latest information about General Electric lamps and help with any lighting job, call your nearest G-E Lamp office.

Have you seen this new booklet—"Modernize with G-E Slimline"? For your free copy, write to General Electric, Department 166-ECM10, Nela Park, Cleveland 12, Ohio.

*You can put your confidence in—*

**GENERAL ELECTRIC**

# in every respect...

# FA Service equipment

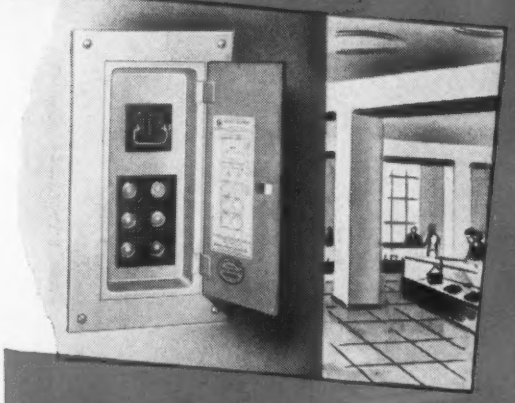
FA Main and Range service units provide plug fuse protection in a dead front, safety type unit and feature non-interchangeable FA Pulfuzswitches (for main and range disconnects). Provides circuit protection in homes where extra capacity is needed. Available in 60 ampere "series," also 60 and 100 ampere "parallel main" connections. Standard enclosures for flush or surface mounting . . . also raintite for outdoors.

In both name and function, FA Service Equipment puts the Accent on Service.

FA Service Equipment is designed and constructed to give years and years of long-lasting, trouble-free performance. Each unit shown not only carries the seal of approval of Underwriters' Laboratories, Inc. but each also exceeds the material, workmanship and design standards by a wide margin.

Every home, small store or similar size building today requires dependable electrical service . . . service that saves the cost and inconvenience of service calls. Although the preference may vary . . . fuse-type or automatic circuit breakers . . . owners can have dependable electrical service when you include FA Service Equipment in their building or remodeling plans.

For full information write for Bulletins No. 201 and No. 202, or see your nearest FA Representative (he's listed in Sweet's).



FA SEPF fuse-protected service equipment with safety-type FA Pulfuzswitch for main disconnect is ideal for residential or small commercial buildings. Available in standard enclosures for flush or surface mounting, and raintite for outdoors. With 30 or 60 ampere main connection, plug fuse branches, and extended feeder connection.

FA Type AC Thermag Circuit Breaker Load Centers are the modern method of circuit protection in the home or store. Automatic trip on dangerous overloads or short circuits; time delay on harmless momentary overload; service restored with flip of handle. 6 circuits or less; main lugs or main circuit breakers. Branch circuits from 15 to 50 amperes, 120 volts or 120–240 volts AC.

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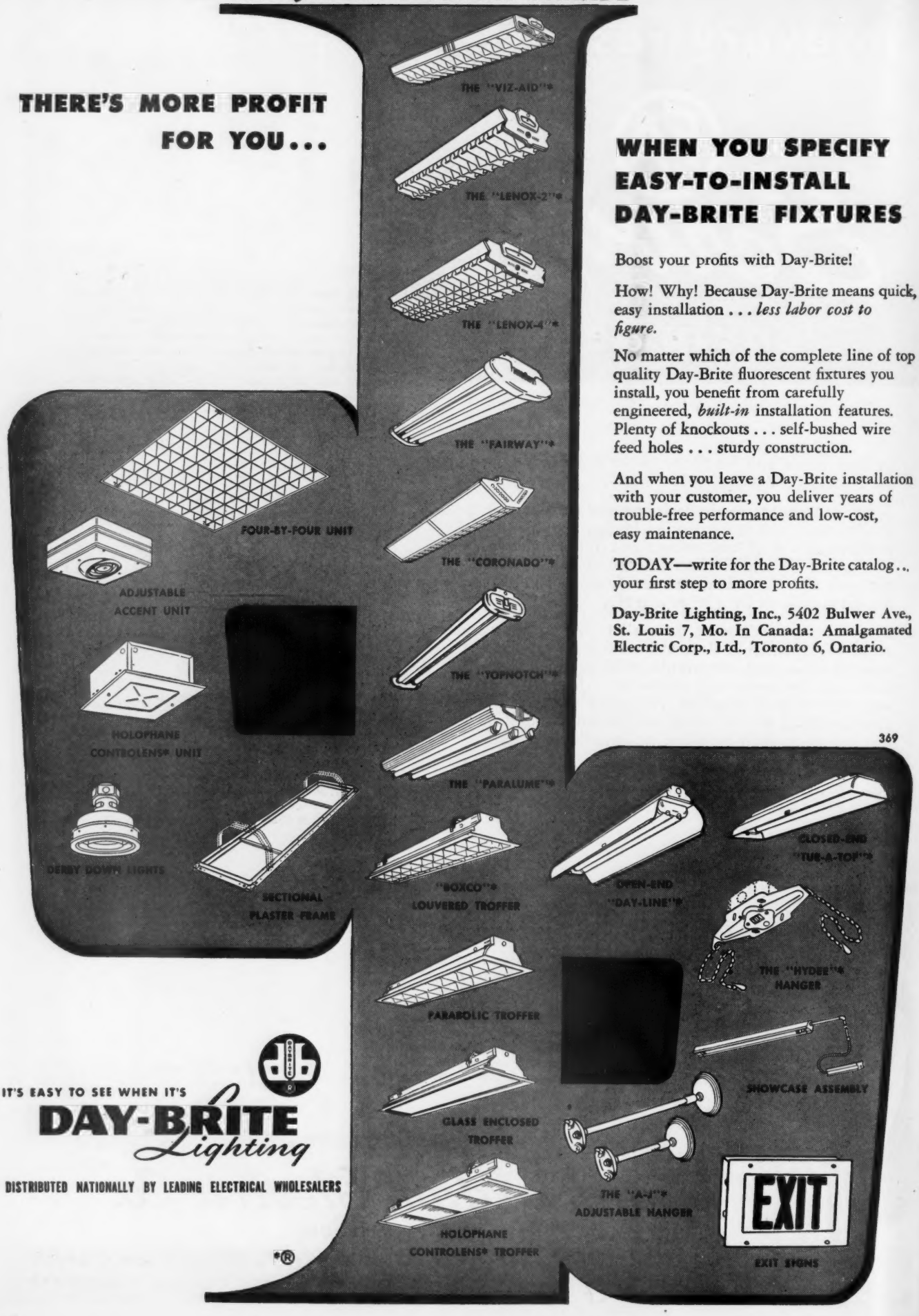


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Boost your profits with Day-Brite!

How! Why! Because Day-Brite means quick, easy installation . . . *less labor cost to figure.*

No matter which of the complete line of top quality Day-Brite fluorescent fixtures you install, you benefit from carefully engineered, *built-in* installation features. Plenty of knockouts . . . self-bushed wire feed holes . . . sturdy construction.

And when you leave a Day-Brite installation with your customer, you deliver years of trouble-free performance and low-cost, easy maintenance.

TODAY—write for the Day-Brite catalog.., your first step to more profits.

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IT'S EASY TO SEE WHEN IT'S

**DAY-BRITE** *Lighting*

DISTRIBUTED NATIONALLY BY LEADING ELECTRICAL WHOLESALERS

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# 2 new 100 amp. pull switches...

***Federal Noark 100 Amp. Main-and-Range Pull Switch...***
***Federal Noark 100 Amp. Pull Switch***

THESE ADDITIONS to the Noark line brings you brand new opportunities to capitalize on Federal Noark engineering and construction. Features that help make these new switches outstanding are:

Federal Noark 100 Amp. Main-and-Range Pull Switch...attractive yet low cost. Single enclosure has capacity for: Main; 100 ampere pullout, 125/250 volt A.C., 3 wire, SN.

Branches; (a) two 60 ampere (or one 60 ampere and one 30 ampere) pull-outs, 3 wire, SN, for range and water heater.

(b) Ten plug fuses, 2 wire, SN branches for lighting circuits.

Bus extension lugs permit sub-feeding to other centralized load panels. Split neutral bars, located beside the rows of plug-fuse terminals, save valuable wiring time—simplify wire identification.

Federal Noark 100 Amp. Pull Switch . . . specially designed for compactness to fit small spaces. Sturdy, simple construction. No hinged joints. Completely dead-front . . . even with puller head out, all live parts are shielded.

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***100 AMP. MAIN-AND-RANGE AND 100 AMP. PULL SWITCHES***

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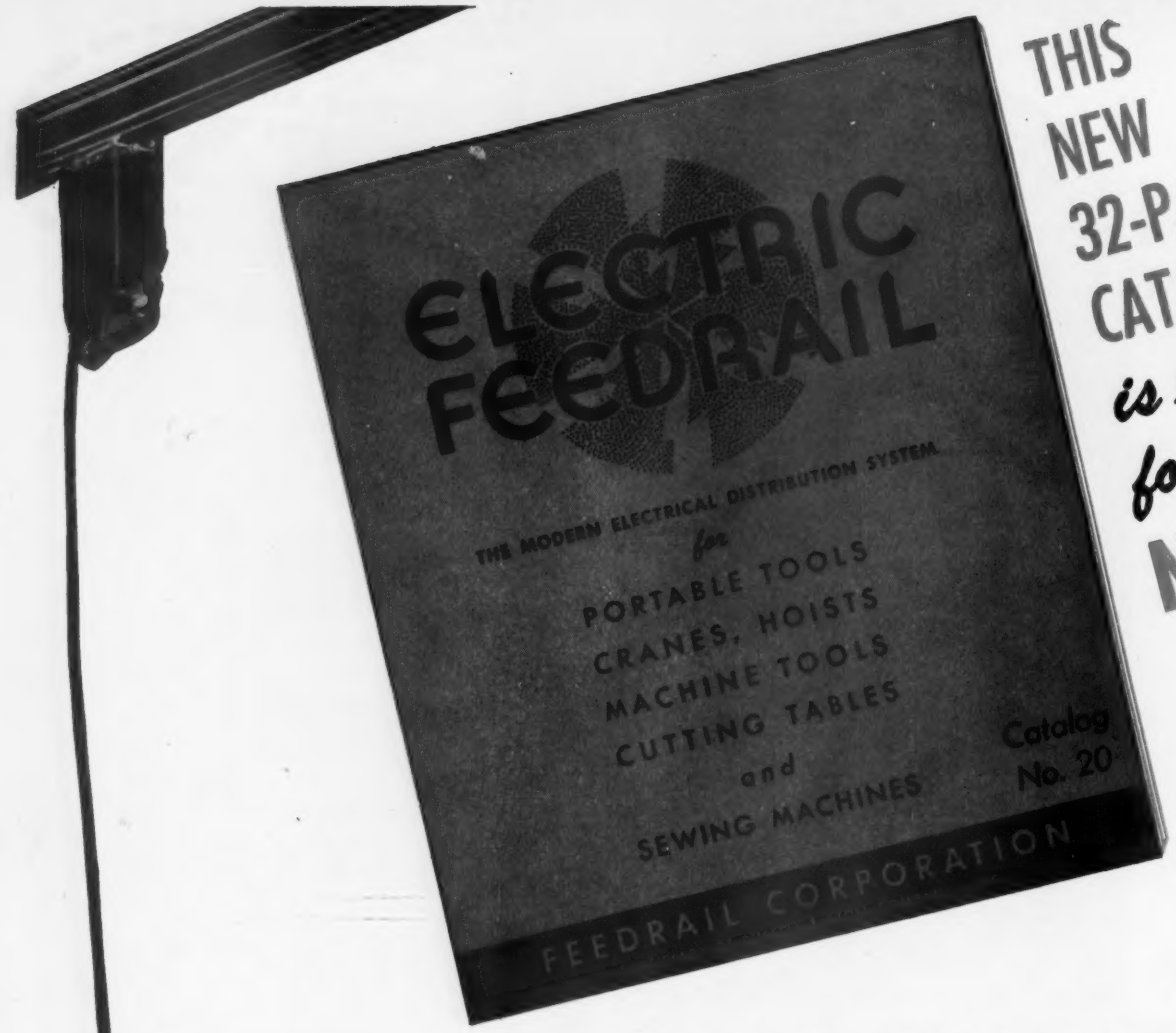


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This 32 page book contains more than 100 illustrations showing how Feedrail speeds production, saves maintenance costs, and eliminates the principal electrical hazards in all kinds of industries.

Also contains mounting diagrams and complete listing of trolleys, track and accessories. Write for your copy now.

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ELECTRIC FEEDRAIL

**FEEDRAIL CORPORATION**

*Subsidiary of Russell & Stoll Company, Inc.*

**125 BARCLAY STREET • NEW YORK 7, N.Y.**

# *MUDDLING* in High Places

It is time for men in Washington and London to stop toying with the problem of international trade. We of the democratic West are at a turning point in our economic affairs. A false step by either the United States or Britain could lead quickly to disintegration of trading between the people of the world as we have known it for the past hundred years. Recent meetings of diplomats in London and Washington have not lifted us out of this danger.

By two simple tests you and I can measure the sincerity of the men in Washington and in London who are trying to solve what they call "the dollar crisis."

**One test applies to the British: Is Britain making an honest effort to re-establish itself as a real competitor in world markets?**

**The other test applies to us in the United States: Are we willing to see Britain re-emerge as a strong competitor in world markets—even in our own home market—and to help her do so?**

**Today, even though both countries have faced the devaluation test, the answer to these questions probably is no.**

## I

The situation we face is, in fact, unprecedented. In every important industrial country of the non-Communist world, except Germany and Japan, production is above prewar volume, thanks largely to the Marshall Plan. Yet trade between nations is shackled as it has never been since the 18th century. And the shackles grow day by day. What is worse, two distinct trading areas—the dollar area and the sterling area—have grown up in the non-Communist world, and the gulf between them grows wider.

What kind of leadership have the United States and Britain had in the face of this crisis? President Truman late in August wisely checked the trans-Atlantic bickering over the dollar crisis. *But Mr. Truman showed no awareness of the basic question that the American people must soon decide: Is the United States able and willing to generate trade between nations, as Britain did in the 19th century?*

What have British leaders offered us? Foreign Secretary Bevin and Chancellor Cripps called their September visit to Washington "one of the most important missions in history." *But they did not tell the British people, and perhaps do not admit themselves, that their Labor government must change its internal and external policies if Britain is ever to earn its living in a competitive world.*

Admittedly, the problem Britain has faced since 1945 is a colossal one. But, in the face of its grave difficulties, what has Britain done? The working day was shortened. Welfare economics have run riot. High taxes have sapped incentives. Labor and capital have clung to their prewar psychology of cartels and featherbedding. Government controls and government trading have hamstrung private initiative. Nationalization schemes have injected politics into the struggle for industrial recovery.

Thus the policies of the Labor government have made Britain's adjustment to its new position in the world immensely more difficult. But Americans who attribute the danger of an international breakdown to British socialism greatly oversimplify the problem. Virtually every country in the world, socialist or not, faces the same dollar crisis that Britain faces.

*continued on next page*

We Americans must recognize that our economic strength unbalances world trade as does Britain's weakness. World War II increased America's superior power to produce goods. It also made the United States more self-sufficient. Thus, while the world demand for American goods has risen, our demand for foreign goods, except for basic raw materials, has not increased. Today we sell more to every major area of the world than we buy from it—and yet we wonder why there is a dollar crisis.

**It is time for us to recognize that there are two fundamentally conflicting pressures at work in the United States. One is our desire for a big surplus of exports over imports. The other is our desire for a system of free-wheeling trade around the world. We can not have both unless we as taxpayers wish to subsidize our exports. Which do we want?**

Curtis E. Calder, chairman of the International Relations Committee of the National Association of Manufacturers, says, "The battle of the foreign trade gap is essentially that of reconciling our urge to export our surpluses with a reluctance to accept imports in payment for them . . . The dilemma is an uncomfortable one to face."

## II

**Here, then, are the basic questions that confront men in Washington and London. Does Britain really want expanding world trade or a high-cost welfare state? Does the United States really want expanding world trade or a huge surplus of exports? So far politicians in Washington and especially in London have ducked these issues because they are political dynamite.**

If the people of Britain decide they want to regain their position as a competitive trader in expanding world markets, here are specific objectives that men in London should set for themselves:

*1. Lower government costs.* The British Treasury has asked for cuts of 5% in 1950. But a cut nearer 15% will be necessary, even if that means fewer government subsidies and health services. Enterprise will never revive nor costs come down while taxes take 40% of the British national income, including roughly 60% of business profits.

*2. Fewer government controls.* Only by removing controls and allocations (except on a few necessities) can Britain begin to return to prices fixed by competition rather than by government fiat.

*3. Stronger anti-monopoly legislation for both business and labor.* Britain needs a concerted drive against all forms of restrictive, high-cost practices. This drive should put teeth in the anti-monopoly act and supplement it with legislation to end restrictions imposed by trade unions.

*4. Less restrictive trading practices.* Britain should retreat gradually from its international barter between governments if competition is ever to have free play in international trade.

Meanwhile, if we of the United States sincerely want multilateral world trade, men in Washington must face up to four problems and hammer out workable solutions:

*1. Use of the International Monetary Fund to back a devalued pound.* In time the Fund, in which we have the controlling voice, might be used to promote convertibility of pounds into dollars.

*2. Help for Britain in meeting war-created external debts.* This might mean support for London in getting a reduction of the war debts Britain owes India, Pakistan and Egypt, for example. To achieve such a debt reduction for Britain we might have to underwrite a part of a Southeast Asia recovery program.

*3. Encouragement of American investments abroad.* Such investments should be directed primarily into enterprises which will earn dollars, such as the development of new sources of raw materials, or which will raise productivity abroad.

*4. Our own tariff barriers.* Our attitude toward this critical issue will be the acid test of how deeply we believe in the merits of free world competition.

**If we really want free, competitive trading between the people of the world, these issues must be met and resolved by leaders on both sides of the Atlantic. If we do not want to face these issues, then let us resign ourselves to a world walled off into three trading areas: the Communist bloc, the sterling area, and the dollar area. So far, Washington and London have muddled along, except in facing the devaluation problem. Clarity and courage are still needed.**

*President, McGraw-Hill Publishing Company, Inc.*

# Easy to Install, too..

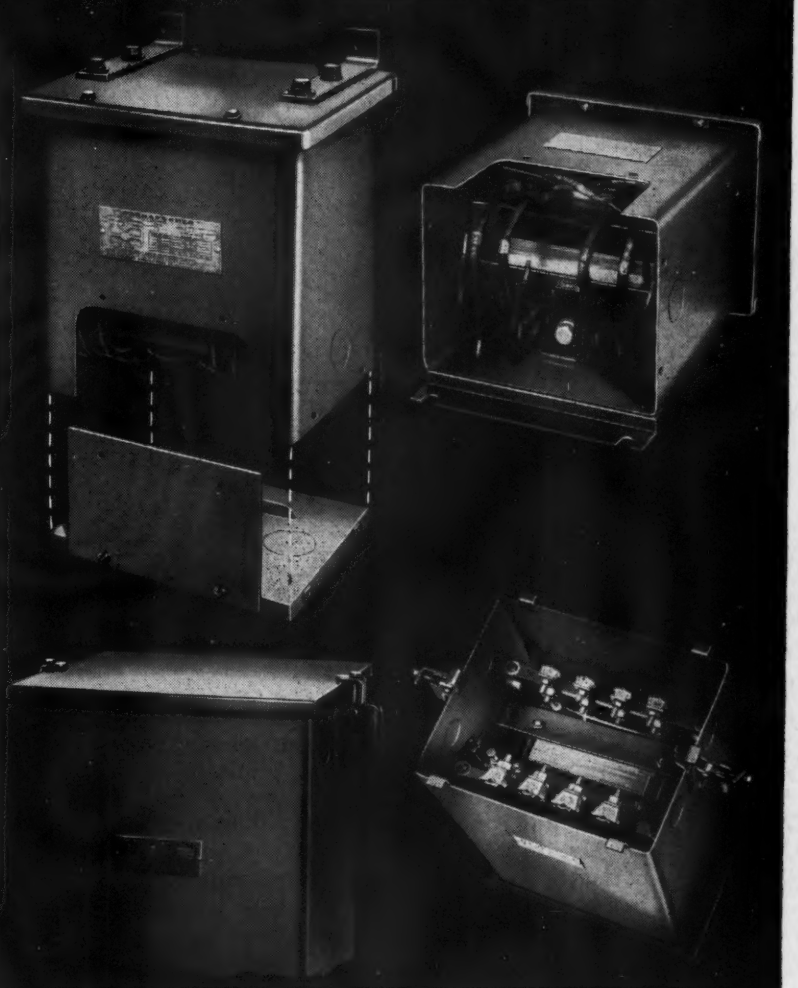
## *Easy-to-Make Connections Speed Hookup of Allis-Chalmers Dry Type Transformers*

HOW IT'S DONE ON RATINGS
**10 KVA AND SMALLER — SINGLE PHASE;**
**25 KVA and SMALLER — THREE PHASE**

FRONT AND BOTTOM PLATES drop out to give plenty of working space. Removable front plate permits you to work from the side instead of directly under unit... means safer, faster, easier installation.

HOW IT'S DONE ON RATINGS
**15 KVA AND LARGER — SINGLE PHASE;**
**37½ KVA AND LARGER — THREE PHASE**

SOLDERLESS CLAMP CONNECTORS reduce hookup time to a matter of minutes. Just remove top cover and then clamp leads to easily accessible solderless connectors. On sizes above 50 kva, single phase, and 100 kva, 3 phase, flat drilled bars are arranged vertically for any style of connector.



EASIER INSTALLATION is just one of the reasons you'll like Allis-Chalmers Dry Type Transformers. In addition . . .

They're lighter and more compact because they're *Fiberglas* insulated. They're *Spra-Bonderized* for added protection against rust. And coils are impregnated to protect windings from moisture and dirt.

Get more information about these Allis-Chalmers Class B insulated Dry Type Transformers... available in 18 sizes up to 300 kva, single and three phase. Contact your nearby Allis-Chalmers dealer or sales office, or write direct for bulletin B6382.

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**ALLIS-CHALMERS**

LIGHTNING can and does strike at unpredictable times and places. When it does, protection to life and property and the correct functioning of electrical equipment depend largely on suitable and permanent ground connections—connections that are maintained in a condition to perform the service for which they were designed and installed.

Make sure that your grounds have adequately-low resistance through the periodic use of a "Megger*" Ground Tester. Available in two models, these instruments measure resistance to earth of ground connections quickly, easily and accurately.

THE HEAVY DUTY "MEGGER" TYPE—built for ruggedness and durability—housed in a teakwood case. Has proportionately divided scales from 0 to 1 ohm (reading in .01 ohm) to as high as 0 to 30,000 ohms, with three, four or five ranges in the same instrument.

THE "MEG" TYPE—smaller and lighter, weighing only 8 pounds—mounted in a cast aluminum case. Scales are logarithmic in character, so as to cover as wide a range as possible within the limits of practical field accuracy. Ranges are single or double up to 3,000 ohms.

For a complete description of "Megger" Ground Testers and the "hows" and "whys" of ground resistance measurement, we invite you to write NOW for Catalog 25-EC.

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*Electrical & Scientific Instruments*

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## Cable pulled from conduit

# AFTER 11 YEARS

## . . . Reinstalled and back in use!

A major midwestern electric utility had occasion to relocate a conduit run in January, 1946.

This run had been wired with ROCKBESTOS A.V.C. cable in June, 1934. The installation was located in damper control circuits around the boiler, where the summer ambient is around 135°F.

When the wire was pulled out in order to relocate the conduit to accommodate equipment changes, the insulation was in excellent condition . . . *after more than 11 years of dependable service under severe conditions.*

After the conduit was relocated, the same ROCKBESTOS A.V.C. cables were pulled back in.

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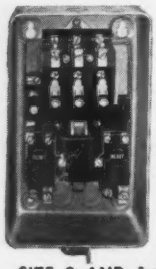
## EASY TO INSTALL • LOW IN MAINTENANCE • DEPENDABLE IN PERFORMANCE

● CLARK Bulletin 6013 Across-the-Line Starters are available for complete protection and starting of motors from fractional to 750 HP —determined by voltage and motor characteristics. All sizes shown have dependable CLARK 7322 Thermal Overload Relay and are sturdily built for heavy-duty operation and low maintenance.



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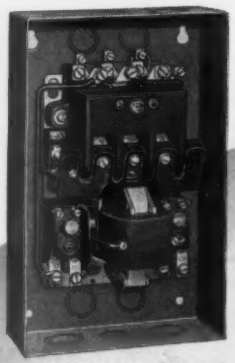

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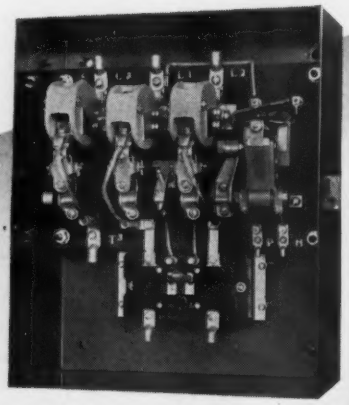

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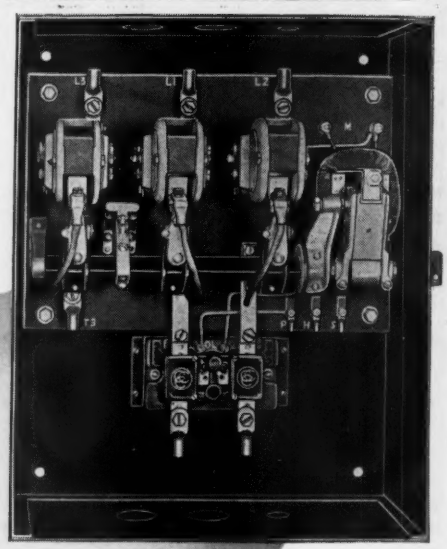

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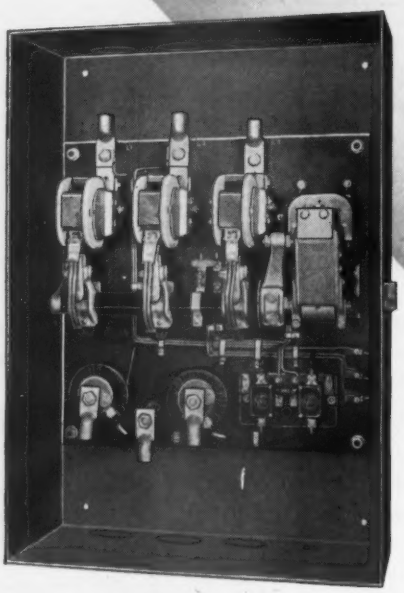

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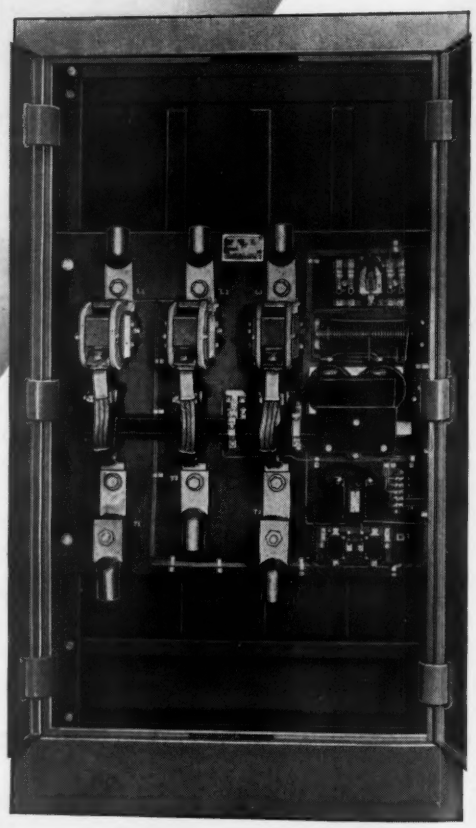
**Available open, or enclosed in NEMA type cabinets to meet varying operating conditions. Easily accessible terminals and plenty of wiring space simplify installations.**

*Available through your* CLARK DISTRIBUTOR



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THE CLARK CONTROLLER CO.

EVERYTHING UNDER CONTROL • 1146 EAST 152nd STREET, CLEVELAND 10, OHIO

# OCTOBER . . . . at a Glance

## Maintenance

In Cleveland Graphite Bronze Company's fifteen acre plant, electrical maintenance is a round-the-clock operation. Cold facts and figures are proving that preventive maintenance routine is paying off. The work includes a methodical system of lighting system maintenance, which replaces lamps well before burnout and maintains design lighting levels. "Preventive Maintenance Pays" begins on page 46.

## Radiant Heating

While electric radiant panel heating is just starting, it will certainly become in time a popular heating system. Still considered a luxury in all but low electric rate areas its actual range of costs in original installation and operation is well within that of past "luxuries" which have attained wide public acceptance. The series "Electric Radiant Heating" is devoted to building a background of essential methods and data for effective electric radiant heat application. In this issue the series continues on page 48 with a discussion of methods for determining required system capacity and probable annual kilowatt-hour consumption.

## Emergency Call

Signalling systems designed to provide for special emergencies, to summon help, to warn of impending dangers require careful layout and selection of equipment. Such systems, though they may be operated infrequently, must always be ready. In many instances equipment at both call and signal stations are distinctive. The field of practical application is varied, systems may be simple or complex. A. A. Schuhler selects several typical systems, discussing equipment selection and wiring layout in his article "Emergency Signal Systems" this month beginning on page 50.

## School Lighting

Adopting the new American Standard Practice for School Lighting sponsored by the Illuminating Engineering Society to practical class room lighting with readily available lighting fixtures and components was the goal of a lighting installation at a Mansfield, Ohio high school. The method of approach, the problems encountered and the results achieved are described by T. D. Wakefield in his article "Lighting Job Meets New I. E. S. Recommendation" on page 52.

## Chick Hatching

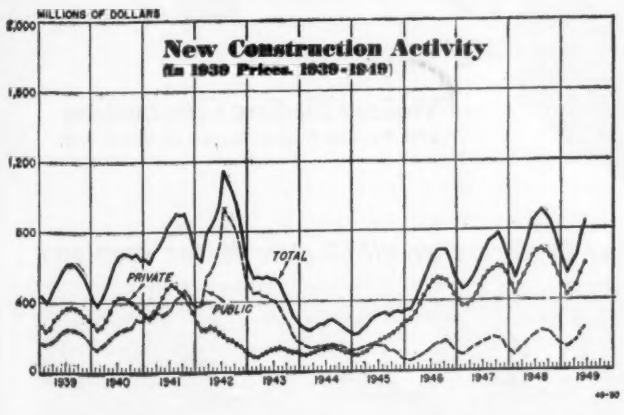
Contractors serving rural areas will be especially interested in an electrical project report from the Del-Mar-Va peninsula beginning on page 54. "Electricity Hatches Chicks" describes the electrical work in the world's largest chick hatchery, where thirty all-electric incubators handles 2⅓ million eggs at a time. The electrical system provides for air-conditioning and humidity control and service continuity is so important that a 100 kva diesel standby is always ready for emergency operation.

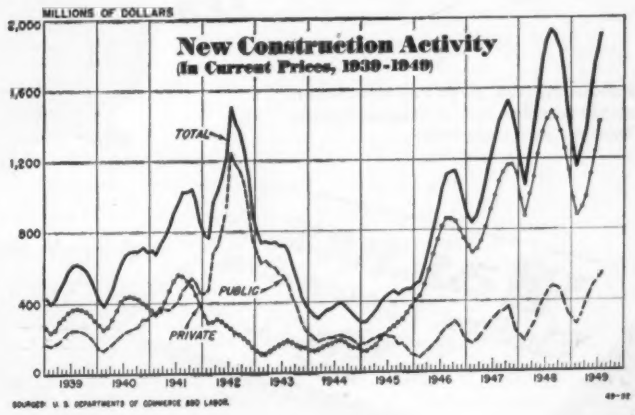
## Reprints

Two recent editorial projects have produced such a large number of requests for reprints that we have made available substantial quantities for those who want them for desk use, data file or distribution to business associates or contacts. "Electrical Specifications", a 64 page master electrical construction specification published in dark blue ink in the July issue, is available in black and white reprint for $1.00. "Planned Lighting System", a 24 page editorial feature from the September issue on appraising and selecting lighting equipment, is available for 25 cents. Please address your request to the editorial department.

## Higher Productivity Lower Costs

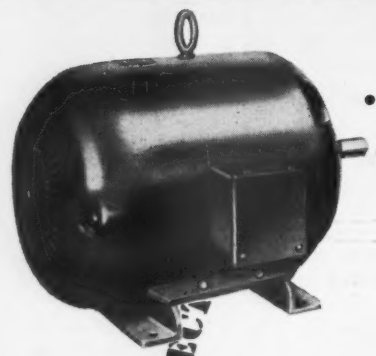
Economic trends of recent months have sharpened competition, increased risks and reduced margins. They have also given new emphasis to cost control, better and more productive methods, more critical selection of materials. In this issue, we are beginning a series of "idea roundups", experience-tested methods from electrical construction jobs, maintenance operation and contractor's offices all over the country, gathered together for quick appraisal and checking. All have been effective toward increasing productivity or cutting costs. They offer a mine of useful methods to use in the office or on the job. "Ways to Lower Costs" begins on page 41.



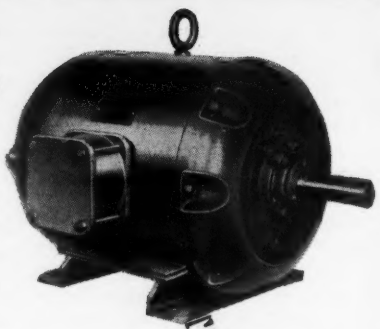
# wherever motor hazards lurk... Specify WAGNER PROTECTED MOTORS

Do you use motors in locations where dirt, filings, moisture, splashing liquids, acid fumes, explosive gases, or other motor hazards lurk? No matter how severe the operating condition, Wagner has the right motor for your purpose—adequately protected against such hazards. Five types of Wagner protected motors are shown below.



PROTECTED • PROTECTED

**1. Wagner Totally-Enclosed Motors . . .**
**PROTECTED** against dust, dirt, abrasives, steel chips, filings, acid fumes, and other harmful elements that may damage the windings and bearings.

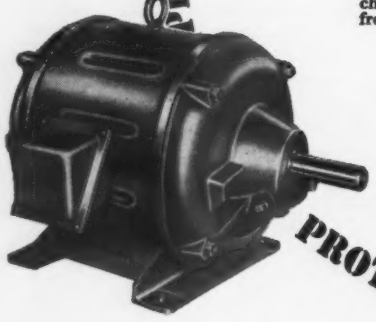


**2. Wagner Explosion-Proof Motors . . .**
**PROTECTED** to prevent explosion in locations where gasoline, petroleum, naphtha, alcohols, acetone, lacquer solvent vapors, or natural gas are manufactured, used, or handled. Approved by Underwriters' Laboratories for Class I Group D hazardous locations.

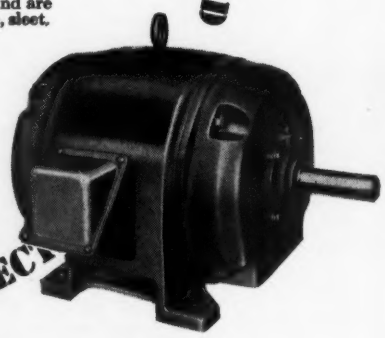
PROTECTED

**3. Wagner Drip-Proof Motors**
**PROTECTED** to keep dripping liquids, falling metal chips and other particles from entering the motor.

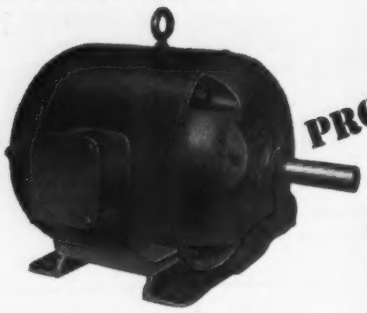
**4. Wagner Splash-Proof Motors . . .**
**PROTECTED** against splashing or dripping water, oil, or other liquids. They are widely used in exposed outdoor locations, and are completely self-protected against ice, sleet, snow and rain.



**5. Wagner Chemical Plant Motors . . .**
**PROTECTED** to resist the action of acids, fumes, moisture and other harmful elements encountered in chemical manufacturing.



PROTECTED PROTECTED

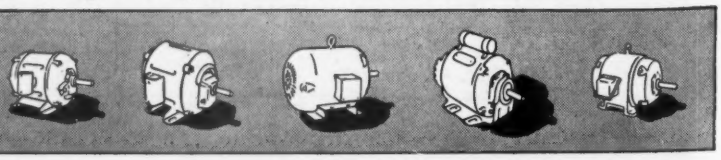


**Bulletin MU-185 gives full information on the complete line of Wagner Motors. Write for your copy today.**

**Wagner Electric Corporation**
**6413 Plymouth Avenue, St. Louis 14, Mo., U. S. A.**

*Consult Wagner Engineers on all Electric Motor Problems*

Wagner Electric Corporation EST. WE 1891



M49-18

• ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE PRODUCTS •

# EXPANDING INDUSTRY

MANUFACTURING TRENDS in mechanical and electrical equipment are toward unit packages. The economies of mass production, assembly and warehousing are in that direction. If application engineering can be built into the product and its current requirements are within branch circuit capacity, distribution can be carried out in conventional merchandising channels. Such appliances as the refrigerator, soldering iron or electric typewriter are typical.

WHEN CURRENT REQUIRMENTS exceed plug-in capacity, however, a line is crossed. The immediate policies and practices of electrical contractors become a part, and often a very critical part of manufacturing, distribution and sales. There can no longer be a sharp distinction between merchandising and installation. They both contribute to the cost and sometimes the usefulness of the product. The electric range is a familiar example.

AS MORE PRODUCTS are developed, they are bound to involve more specialized wiring, installation skill and application engineering. The electrical contractor is ideally equipped and staffed to expedite such work and usually participates in normal course, at least in the wiring. But is a secondary installation role in the best interest of the manufacturer, of the electrical industry and of the public?

EVERY ELECTRICAL CONTRACTOR is not by definition a prime agency for specialized products requiring technical installation. Some have neither equipment, staff nor policy to handle sales and application engineering. But many do. And they offer a medium far better equipped for effective marketing of technical equipment than the traditional sales agency which cannot produce even the ultimate consumer package, the installed job.

THREE EXPANDING MARKETS of enormous potential in the immediate foreground bear directly on the problem; lighting, electric heating, air conditioning. New construction is only a small part of each market. With modern unit manufacture; typically the louverall ceiling, the radiant heat panel, the unit air conditioner; application engineering and electrical work are major and critical elements in effective marketing. The contractor's key role in lightng is already widely recognized, his place in panel heating is obvious, and some of the most effective work in air conditioning sales has been done by electrical contractors.

IN THIS EXPANDING INDUSTRY the electrical contractor has a most profound decision to make; to exploit his share of the comfortably growing demand for pipe and wire and outlet boxes or to create an expanding electrical service to the public and to offer a responsible and highly competent sales engineering outlet for apparatus and utilization equipment. In the other branches of the industry, there is a similar choice, to limit contractor participation to the minimum or to foster to the utmost the contractor's enormous, and largely undevelped, potential for local marketing.

THE CHOICES will not be made in terms of high industry policy. They will be made by business men with a hard headed concern for risk and profit. Electrically operated equipment will increasingly require engineering sales and skilled installation. The ideal outlet in any city would necessarily bear a close resemblance to a modern electrical contractor.

Wm. F. Stuart

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## SPECIALIZED HELP

To help you and your customer plan complicated wiring systems or solve difficult wiring problems, a Graybar Inside Construction Specialist is available for consultation. His recommendations, supplementing those of your local Graybar Representative, will help to speed up performance of your contract from start to finish.

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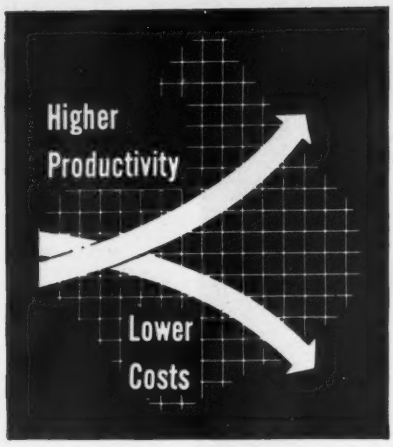



# WAYS TO LOWER COSTS

**Experience-tested methods for better production, lower costs and improved efficiency; a selected list of current industry practices and techniques.**

*Methods are the levers of management, to gain advantage over costs and to improve the ratio of value to cost in production. In modern practice higher productivity is rarely a matter of greater or more sustained labor effort. Most productive of modern techniques are those in which labor effort is emphasized through methods and machines to larger advantage or to better effect.*

*In electrical construction and maintenance operations, higher productivity and lower costs are attainable through several channels.*

1. *Management policies and methods to standardize, simplify and expedite office and job procedures.*
2. *Discrete selection of materials and apparatus with reference to use values and* installed *cost.*
3. *Skill and ingenuity in job methods and practices.*
4. *Effective use of tools to supplement labor skills.*

## Cost Saving in Construction

The need for higher productivity and lower costs is paramount in the current economic era. Market opportunities may be shown as a pyramid with the altitude representing cost and a plane cross-section the market potential. As costs rise, the market area shrinks, when they are reduced, larger and larger market potentials are reached. The goods and services of the electrical construction industry are needed and desired by a much larger market than can ever be fully satisfied but the segment we can reach will be determined by the values we can offer.

This article is the first of a continuing series emphasizing management responsibility for providing better values to meet today's economic requirements. It presents a list of experience-tested ideas that have helped to increase productivity or lower costs.

## 1. Job Schedules

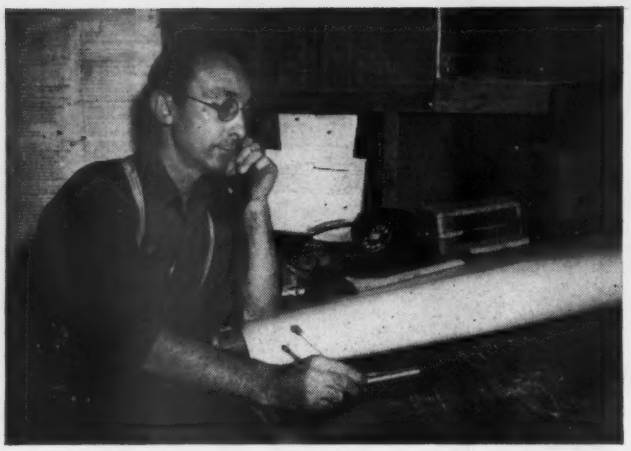
Effective job management depends on good scheduling of materials and manpower in close accord with construction progress. The differing time elements involved in procurement and the overlapping in time of different elements of the job can be planned for and followed up on a comprehensive job schedule. Usually a large plan-size schedule mounted on heavy cardboard is used. Vertical lines mark off the days. Horizontal lines are provided for operating portions of the job, by areas or floors and for different systems and apparatus installation. Color codes or symbols indicate essential data; material orders, shipping promises, dates of shipments, installation progress, etc.

## 2. Working Drawings

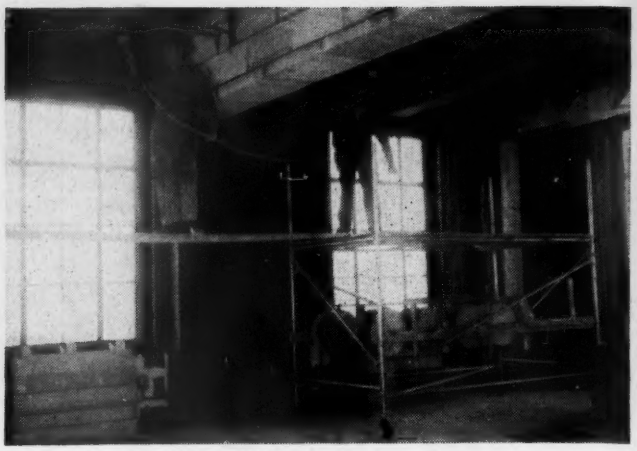
Project plans are rarely sufficiently detailed on electrical work to use efficiently as working drawings. Working drawings should be prepared in sufficient detail to reduce on-the-job decision to a minimum. All conduit runs should be indicated in actual layout with sizes clearly indicated. Conflicts with other mechanical or structural features or critical space conditions should be clearly detailed in large scale. It is usually desirable to show different wiring systems on separate working drawings to leave ample room for job checking and plan notes.

## 3. Equipment Taps

On short runs from distribution panels, controls or subfeeder cutouts to large equipment AVA cables offer economies in conduit size. Code ratings permit higher current carrying capacities; typically, No. 12 to 30 amperes, No. 0 to 200 amperes; with a consequent reduction in required conduit and fitting sizes. Long runs at such rating on secondary voltages are not likely to be practical because of excessive voltage drop. On short runs or where drop at full load is not a critical consideration, the method is useful and often economical. Another application of the same technique is tight elbows from floor feeder down or up to distribution cabinets. The smaller conduit requirements permit an elbow of substantially shorter radius.



*Mechanic on 15th floor receives instructions from sub-basement field office on hotel project.*

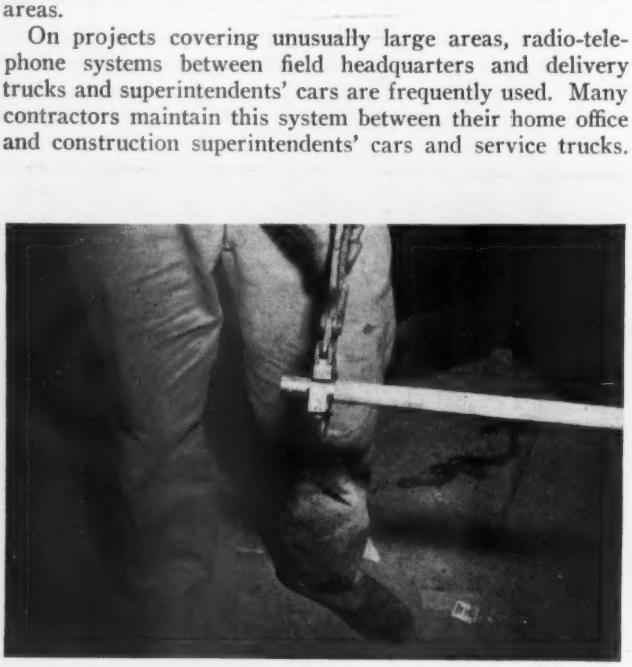


*Scaffolds of light metal and demountable design expedite overhead work with improved safety.*

## 4. Job Expediting

One of the prime functions of a job superintendent is to expedite construction and keep non-productive labor to a minimum. Telephone access to the home office, warehouse, suppliers and owner's representatives is essential to maintain control over materials, labor and engineering changes. Of equal importance is an intercommunicating system on the project itself for prompt relaying of instructions, material requisitions, change orders and other items to mechanics in actual work areas. An independent telephone system is usually installed between field office and various work areas.

On projects covering unusually large areas, radio-telephone systems between field headquarters and delivery trucks and superintendents' cars are frequently used. Many contractors maintain this system between their home office and construction superintendents' cars and service trucks.



*Making crimp connection on thin-wall conduit.*

## 5. Thin-Wall Conduit

Where application is permissible by the National Electrical Code (Article 348) and local codes, electrical metallic tubing (thin-wall conduit) offers installation economies. Tubing is light in weight; requires no threading; uses pressure of the crimp type couplings and connections; is used extensively in commercial and residential work. Maximum size is 2-inch. Tubing has same conductor capacity as conduit.

## 6. Rolling Scaffolds

A vital "tool" on most electrical construction projects, be they large or small, is one or more rolling scaffolds of lightweight metal or alloy that can be quickly dismantled and reassembled. Construction design should permit on-the-job assembly to meet such varying installation conditions as: straddling machines or desks; light or heavy conduit installations; branch circuit conductor work, lighting fixture installations. Some contractors add a lower platform to the scaffold to accommodate tool boxes, pipe threading machines, etc; others add wire reel holders for branch circuit installations. Adaptations of crows' nest ladders on hand trucks have also been made. All types should lock into stationary position when in place.

Industrial platform lift trucks are advantageous for lifting heavy conduit, bus duct assemblies and other equipment into position for overhead installation.

## 7. Pipe Machines

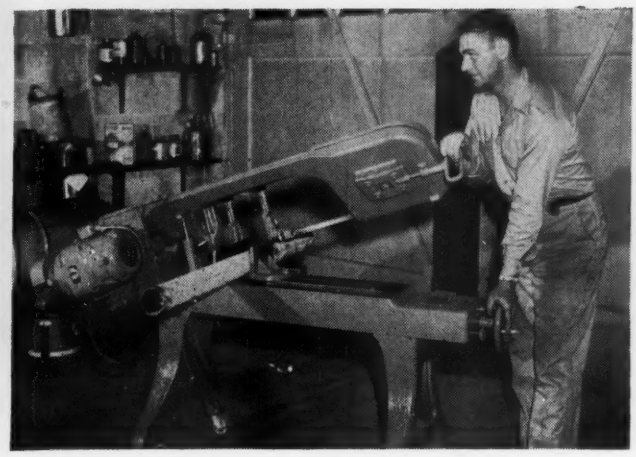
Pipe machines are a necessary power tool on projects involving large conduit sizes, particularly for threading and reaming. Cutting, in large quantities, might be accomplished faster on band saws. Recent development of portable pipe machines for small size conduit can substantially improve unit costs if a sufficient number of units are strategically spotted throughout the installation area. Wherever mass cutting and threading are planned, power equipment should be used. All power operated equipment should be mobile, with at least two casters on supporting legs to facilitate movement from area to area.

On projects having no temporary electric power facilities, one or more portable gasoline-driven generators should be employed to permit use of time-saving power tools and equipment.

## 8. Fastening Tools and Techniques

The use of clamp-type devices and spot welding of brackets for mounting of electrical equipment offers installation economies over the former technique of punching and drilling structural steel members. Mounting clamps can be quickly removed and reused in case of a circuit shift or equipment rearrangement; welding provides strength and rigidity where permanence and vibration are factors; both techniques preserve original strength of structural members.

Inserts can now be driven into concrete with a power actuated tool in a fraction of the time required by drilling. Where rotary drills are employed, use of special tipped (Carboloy, etc.) drills speed the job and increase drill life.



*Metal cutting band saws substantially reduce manhours on construction projects.*

*Bracket fabricating stand has shear, punch and bender for on-the-job fabrication of supports.*

## 9. Drilling and Cutting Tools

One of the most versatile cost-cutting power tools is the portable electric drill. Depending upon job requirements it can be used as a hand drill; in a stand as a drill press; on an extension bar for high work; with a circular saw adapter as a hole cutter. Most recent development in this field is an impact drill that will not stall under heavy loads; provides slow-speed impact motion for tapping, screw driving, nut running as well as all types of drilling jobs. Electric hammers replace the bull point and sledge for all types of masonry drilling, cutting and chasing.

Power saws of the reciprocating hack saw and continuous band saw type speed metal cutting on the construction project. A change of blade accommodates steel, copper, bronze, or aluminum. Many contractors prefer the speedier band saw to the slower hack saw. Special machines are also available for cutting smooth, round openings in concrete floors with a rotary action that eliminates vibration of hammer type units.

## 10. Pulling Conduits In Ducts

If necessary, conduit can be *pulled* in underfloor, covered trenches or ducts with conventional steel cable winch and power unit. Cable attachment is made by standard conduit coupling with pipe plug and welded eye-bolt assembly. Bolt is free to turn in hole in plug and is held by washer and double-nut anchor. Pull can be made in 10-ft. or 20-ft. "hitches" depending upon opening at duct entrance in which conduit sections are coupled together. Scheme was used to pull in two 650-ft. runs of 4-inch conduit; eliminated need for cutting through concrete floor along duct length.

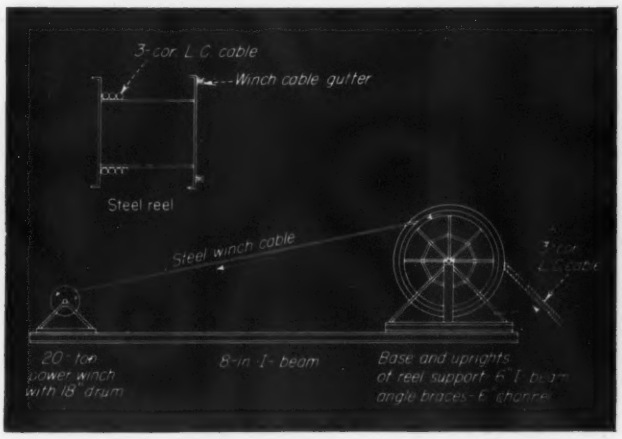
## 11. Load Center Layouts

Substantial economies in electrical distribution systems can be attained by keeping low-voltage circuits to practical minimum lengths. This means bringing the primary distribution feeders as close as possible to the center of concentrated electrical loads. Application of Load Center Unit Substations (incorporating primary disconnects, transformers and secondary switchgear) make this feasible. Units using air-cooled or non-inflammable liquid cooled transformers can be placed in center of work area or on balconies or roof locations to conserve space. No enclosing vault is necessary. Number of substations will depend upon size of plant, connected load and number of load concentration areas.

## 12. Fabricating Brackets

Application of modern tools substantially reduces the time required to fabricate angle-iron brackets for wall and free-standing support of electrical control equipment. A typical fabricating stand includes a shear for cutting the iron, a punch for notching and a bender to shape the bracket.

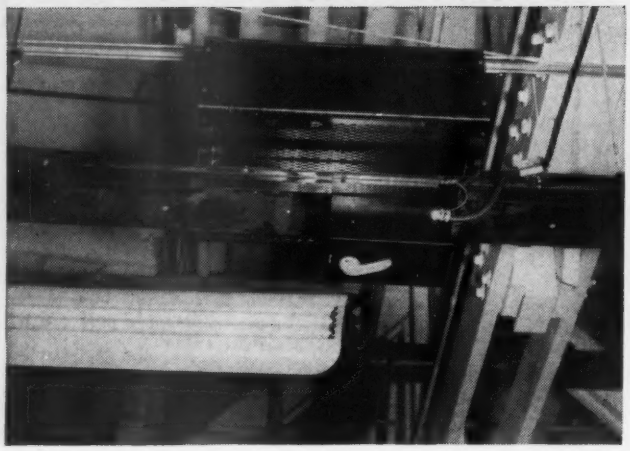
The use of a specifically designed steel framing member (Unistrut) with easily positioned nut and bolt fastening may produce additional economies. System eliminates layout and drilling of mounting holes; provides mounting access along entire length of channel; facilitates quick alignment of control equipment with conduit drops or stub-ups.


3-cor. L.C. cable
Winch cable gutter
Steel reel
Steel winch cable
20-ton power winch with 18" drum
8-in. I-beam
Base and uprights of reel support 6" I beam angle braces 5" channel

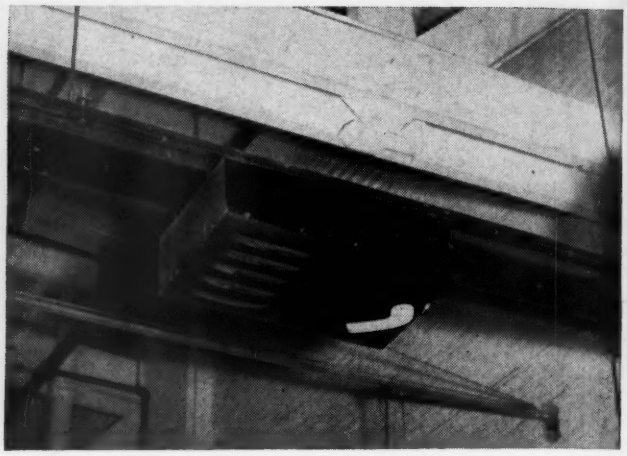
*Cable salvage unit winds cable around special reel as it is pulled out of underground ducts.*

## 13. Removing Underground Cables

Underground cables, particularly lead-covered, can be pulled out of ducts and wound on a reel in a single operation. Specially designed all-steel reel with a winch-cable gutter-rim attached to one side does the job. Enough steel cable for a 500-foot "pull" is fastened to and wound around gutter-rim. Other end is attached to power which mounted on same I-beam frame as real supports. As winch drum takes up steel cable, reel turns counter-clockwise and winds electrical cable as it is pulled out of ducts. Scheme eliminates dragging lead cables on ground and damaging the sheath.



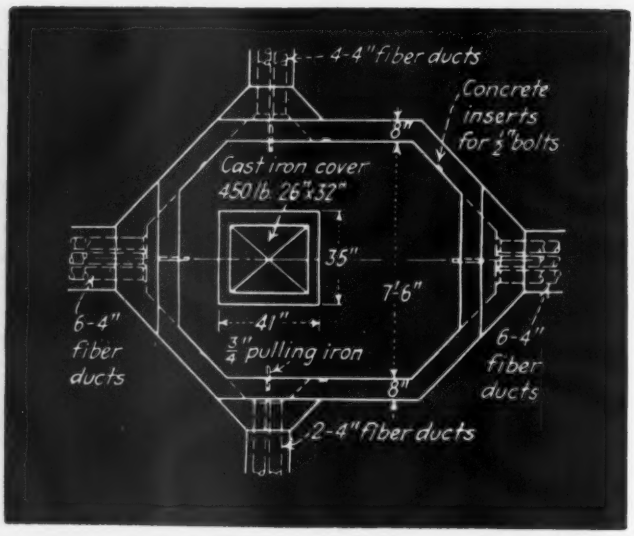
*Rectifier plug on bus duct circuit provides local d-c supply for machine tool.*



*Capacitor plug provides power factor correction at end of a bus duct circuit.*

## 14. Local D-C Supply

Spot conservation of alternating current has economically solved the direct current supply problem where relatively small blocks of d-c are necessary on specific production machines. Rectifier plugs for bus duct systems and small rectifiers that mount on the machine itself provide current for magnetic chucks on grinders, d-c motors on machine tools, and other equipment. Where numerous machines in the same area require direct current, a modified d-c distribution system might prove economical. Where large blocks of direct current are necessary, a distribution system might be served by small conversion units (motor-generator or rectifier) connected to substation secondary buses.




*Plan view showing features of octagonal concrete manhole.*

## 15. Octagonal Manholes

Octagonal design of concrete manholes provided an overall saving of from 10 to 15 percent (excavation, forms, concrete, cover, backfill) over conventional rectangular manhole cost, on a large underground distribution system. A reduction of cable installation time was also effected by the better anchoring facilities and protruding end-bell entrance that permitted easy training of the large cables. Reduction of the 8-inch wall thickness by 50 percent and offsetting of reinforcing steel at points where future conduits may enter manhole provides easy access for additional runs.

## 16. Power Factor Correction

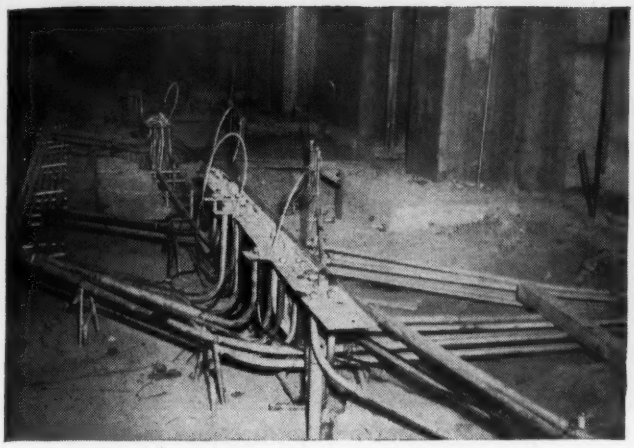
Low Power Factor can be one of the least apparent, yet most prevalent basic causes of increased electrical losses on an alternating current system—especially if most of the connected load is of the inductive type. By definition, power factor is the ratio between true watts (useful work) and the apparent watts drawn by the equipment and registered on the meters (paid for by customer). The wasted current (non-useful work), in the form of circulating magnetizing currents (required by induction type equipment), places added loads on the circuits, increases voltage drop and electrical losses, causes motors to operate hotter and slower at the lower voltages.

Biggest causes of low power factor are induction motors running at no-load (idling) or partial load (over-motored machines). Correction of this condition will step up power factor and reduce losses in proportion. Additional power factor correction can be accomplished (to a practical value of 90 to 95 percent) by adding capacitors to feeders, branch circuits or individual machines to remove the circulating current load from the circuits. Result: Increased utilization voltage, reduced line losses, increased feeder capacity. Synchronous motors produce similar results when their fields are over-excited (motor draws leading current from line). Power factor correcting capacitors are usually located at or near motor locations. On bus systems connections may be conveniently plugged in adjacent to motor circuit taps.

## 17. High Voltage Distribution

High voltage primary distribution and short secondary circuits provide a means of keeping full-load losses of an electrical system to an absolute minimum. Since these losses, per kva., vary approximately inversely as the square of circuit voltage, the higher the primary and utilization voltages used, the lower the losses encountered. In general, 4,160 and 13,200 volts are recommended for primary distribution (report of A.I.E.E. Committee on Industrial Power Applications); 460 volts for secondary circuits.

If the interrupting duty can be kept below 50,000 kva. at 4,160 volts, 5 kv. switchgear can be used; above 50,000 kva., 15 kv. switchgear with 13.2 kv. distribution will prove more economical. Intermediate primary voltages (2,400 and 6,900) should be considered only if greater portion of load comprises large motors best adapted to these voltages. In any case, choice of primary distribution voltage will depend upon the type and size of load, and the economics of switchgear and cable costs.



*Steel template holds conduit stubs in place before concrete floor is poured. Switchboard will be set above terminals.*

## 18. Templates for Conduit Alignment

Steel templates provide practical installation economies in conduit work; hold conduit stubs in position during concrete pour; eliminate the need for realigning to fit switchgear and distribution panel entrance requirements. Similar scheme can be applied to permanent brackets for exposed branch circuit conduits entering or leaving column-mounted distribution cabinets. Where numerous large conduits occur in concealed work, wood templates or supports can be used in similar manner.

## 19. Power Plug-In Systems

The present-day ultimate in secondary distribution flexibility is provided by plug-in busways that permit branch circuit tap-offs at about 24-inch intervals and trolley ducts that provide continuously available access for stationary or trolley-type connections. The systems can be installed economically; can be completely salvaged for reuse; are especially adaptable to areas where department rearrangement, expansion, or changing loads may frequently occur.

Plug-in devices include switches, circuit breakers, capacitors, rectifiers, ground detectors and static voltage protectors, Plug-ins can be installed or removed in a few minutes. Machine connections need not be disturbed. Trolley busways are particularly adaptable for electrical tools over production lines and for lighting systems where patterns and intensities might be varied from time to time.

## 20. Wireways and Raceways

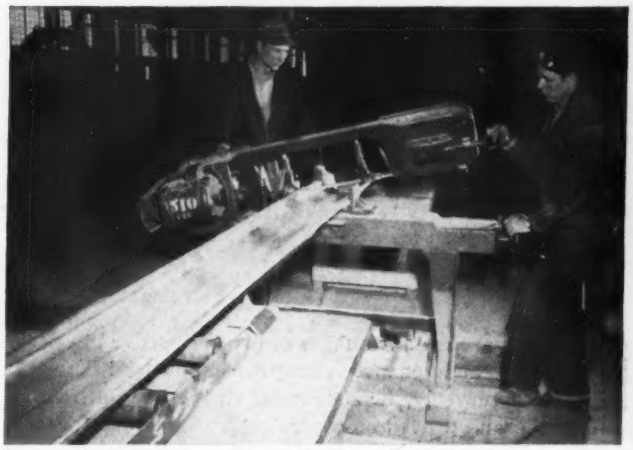
Wireways, prefabricated metal troughs with conduit outlets at close spacing, offer installation economies when used exposed in dry, non-corrosive locations where quantities of small size conductors are involved. They are especially applicable to control circuit or lighting branch circuit work; have full-length hinged or screw covers that facilitate conductor installation and subsequent maintenance inspection. Surface metal raceways have similar application where fewer conductors are involved.

Underfloor raceways, both metal and fiber, offer an economical means of providing numerous electrical outlets at floor locations; are used extensively in commercial building work. Channels formed by cellular metal flooring can be used in similar manner; require installation of only feeder ducts, access and outlet units. In all cases, entrance fittings must be kept accessible.

*Lightweight conduits are easy on mechanics muscles; reduce material handling cost on conduit installation projects.*

## 21. Lightweight Conduits and Cables

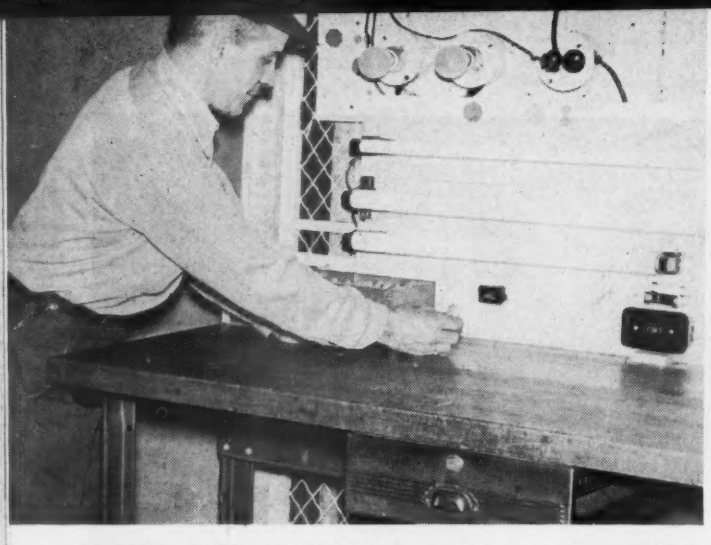
Substantial installation economies can be effected by using lightweight conduit and cables in larger sizes, particularly where installation is in high-bay areas. Aluminum conduit weighs about one-third that of steel conduit of same size and thickness; the weight ratio for the same current carrying capacity of aluminum and copper bus bars is about 50 percent; that for larger size cables, about 45 percent. On one large project using aluminum cables and conduits, substantial savings in cable cost were reported plus an over-all saving in labor cost (due to weight advantage) of about 30 percent compared to conventional steel and copper installation.



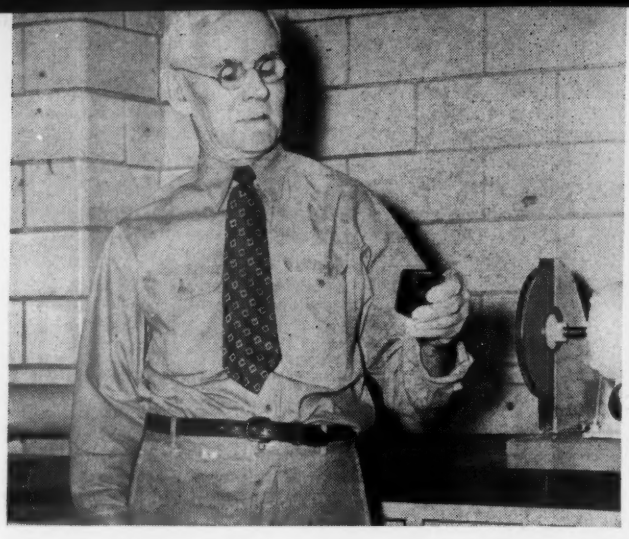
*Roller conveyors, long assembly tables and band saw speed field fabrication of aluminum sector bus.*

## 22. Assembly Line Techniques

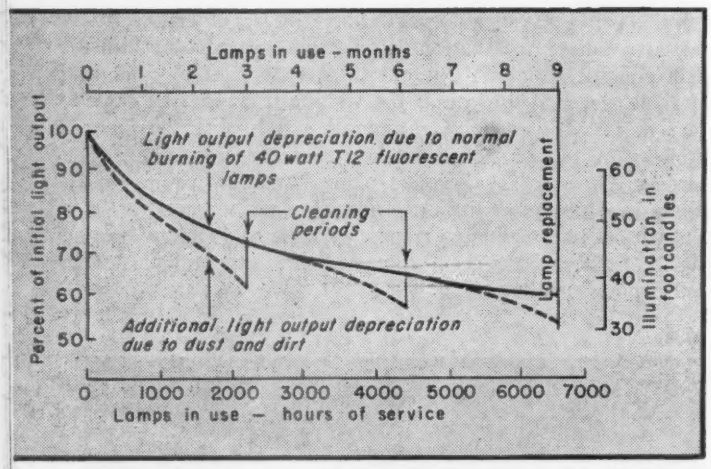
Field fabrication of numerous items that comprise an electrical distribution system lends itself to the application of time-saving mass production techniques. Assembly tables, roller conveyors and electrically operated tools combine to increase productivity of the mechanics. Fixtures can be wired and assembled complete with stems before installation; mounting brackets can be mass-produced by cutting, bending and welding in successive steps; duplicate conduit runs (as for housing projects) can be cut and assembled with outlet boxes, then bundled for installation; small concrete manholes or handholes (as for airport projects) can be precast in quantity.



TESTING LAMP STARTERS, *in addition to testing the lamps and ballasts, is normal procedure at Cleveland Graphite Bronze. Combination starters and circuit breakers, initially installed, are now being replaced by Watchdog starters on a standard replacement basis.*



LIGHTING MAINTENANCE ENGINEER, *Martin Madden, checks footcandle levels daily in all plant and office areas with light meter. Blinking, swirling, blackening and dim lamps are immediately replaced and the cause of the trouble is promptly checked and rectified.*


Lamps in use – months
0 1 2 3 4 5 6 7 8 9
Percent of initial light output
100 90 80 70 60 50
Light output depreciation due to normal burning of 40 watt T12 fluorescent lamps
Cleaning periods
Lamp replacement
Additional light output depreciation due to dust and dirt
60 50 40 30
Illumination in footcandles
0 1000 2000 3000 4000 5000 6000 7000
Lamps in use – hours of service

DEPRECIATION IN LIGHT OUTPUT *normally approximates 38 percent after 6300 hours of continuous service. Accumulation of dirt and dust on lamps and fixtures further reduces output by 7 to 10 footcandles between cleaning intervals, dramatically emphasizing importance of planned maintenance.*

# Preventive

**The application of modern tools, methods and instruments in connection with routine checking, cleaning and repairing of equipment promotes plant economy, efficiency and safety.**

**By H. P. Scott**

RARELY are the advantages of preventive maintenance recognized so unreservedly, demonstrated so effectively, and proved so conclusively as they are at the Cleveland Graphite Bronze Company's modern 15-acre plant in Cleveland, Ohio. For there, maintenance is a round-the-clock continuous routine, with a scope ranging from service entrances and transformer vaults to industrial trucks and welding equipment. National attention has been focussed on the lighting maintenance program in particular. And hard, cold facts and figures prove that this all-out approach contributes positive values to the company's economic stability.

The plant, in its own right, deserves comment. For, with its high level-illumination, air conditioning, safety-promoted color schemes and comprehensive physical equipment, it is an industrial showplace. Employees not only enjoy attractive cafeterias, lounges and locker rooms, but also have the advantage of receiving periodic chest X-rays and physical examinations. With such a program for checking the condition of personnel as well as checking the physical equipment in the plant, it is no mere coincidence that the company's accident rate is among the very lowest in the manufacturing industries, and it rightly can be said that preventive maintenance comprehensively and wisely includes machinery, materials and manpower.

Since lighting, due to its appeal, receives initial attention from visitors to the plant, the lighting maintenance program likewise merits primary consideration. In all, there are 11,000 fluorescent fixtures containing 17,000 four-foot 40-watt lamps to illuminate 560,000 square feet of manufacturing area. An additional 130,000 square feet is lighted by a combination of mercury vapor and incandescent lamps spaced alternately. These installations, combined with the lighting of offices, exteriors and utility areas, result in a connected load of 1200-kva. Footcandle levels approximate 40 throughout the factory, with intensities of 50 footcandles or better in inspection areas and over certain critical operations.

Recognizing that light loss is caused by the combination of (1) low voltage, (2) lamp depreciation, (3) outages, (4) inefficient luminaire design, (5) light-absorbing surfaces of surrounding reflecting areas, (6) dirt and dust, the maintenance program includes many

**VOLTAGE BETWEEN SOCKETS** *is tested by assistant light inspector, Milan Poplar, to insure proper starting and continued burning at rated voltages. Low voltage is recognized as one of the six factors affecting light output, so this item is included in routine maintenance assignments.*

# Maintenance Pays

**CLEANING THE LAMPS AND FIXTURES** *is a continuous process, with six men completely covering the plant every 12 weeks. All lamps are dated so that cleaners can recognize and replace tubes in service for more than 6300 hours. Cleaning teams rotate in their assignments to minimize fatigue.*

items not immediately associated with the fixtures and lamps. For example, voltage readings are taken daily at all load centers; weekly in the main transformer vaults. Load surveys are also compiled each month (with ampere and voltage readings taken at 90-minute intervals for three consecutive days) to determine whether plant load centers have shifted in position or magnitude. High-reflectance cream paint is used on walls and ceilings to minimize light absorption by these surfaces. And all circulated air is washed at intakes, so that normal dust content is minimized.

Cleaning of lamps and fixtures is a continuous function, with six men working nightly, making a complete round of the factory and office fixtures every twelve weeks. Fixtures and lamps are cleaned with a solution of Solvental, a soap powder product. Operating in teams of two, one cleaner climbs a ladder, disengages the lamps and passes them to his partner below. Then, while the lamps are being washed by the man on the floor, the fixture is cleaned by the man above. After this dual cleaning, lamps are passed back to the worker on the ladder and reinstalled. Men alternate frequently in their assignments so that fatigue from working on the ladder is minimized. Although the washed air in the plant is relatively clean, and the cleaning intervals are considerably shorter than in the majority of comparable industrial plants, these washings regularly result in an increase in light output of from 7 to 10 foot candles, demonstrating the value of such cleaning routines.

Dating the lamps is another standard procedure, with the year and month of installation typed on a white sticker and placed at one end of the fluorescent tube. Stickers are positioned so that, when they are on the upper side of the lamp, the tube is properly installed and cannot fall from the fixture sockets. Since lamps burn almost continuously night and day, the hours of in-service use can be closely checked at each cleaning, and lamps are replaced during their ninth month of service (around 6300 hours). Since continuous burning of lamps generally results in fluorescent lamp life between 7500 and 10,000 hours, lamps are replaced many hours before their anticipated failure point. However, after nine months, normal lumen output has decreased approximately 36 percent and, beyond this point, burnouts and end-blackening increase too rapidly to justify a longer period of doubtful, inefficient service.

The wisdom of this practice is visibly demonstrated by the almost complete absence of these objectionable factors. Also, by replacing lamps on an orderly, prearranged time-schedule before lamps actually black out, it becomes unnecessary for a man to make a separate trip each time a lamp becomes inoperative. Still another advantage to time-schedule relamping is the fact that, since this function is performed on the third shift, interruptions to normal manufacturing operations are eliminated.

In addition to scheduled relamping and cleaning, daily supervisory inspections are made to check for unanticipated reductions in footcandle levels and for lamps blinking or swirling. Whenever these unusual conditions are encountered, lamps are immediately re-

(*Continued on page* 64)

# ELECTRIC RADIANT HEATING

**Design consideration for system capacity and annual energy cost.**

ELECTRIC radiant heating, like any other heating system, must provide for 1) heat loss balance and 2) temperature pick-up. Any heated interior in cold weather looses heat in predictable amounts per interval of time to the outdoors. If the heating system provides precisely the same amount of heat at the same rate, the inside temperature remains constant. The heat loss is related to the temperature difference, thus the system must have enough *capacity* to balance the heat loss during the *coldest* weather.

In heating applications it is common practice to design systems to meet a particular local design temperature. This temperature for any locality is 10 to 15 degrees above the *lowest temperature ever recorded.*

As explained in the August article, to find your local design temperature consult your local weather bureau for the lowest recorded temperature and add 15 degrees. (For Trenton, N. J. the lowest temperature recorded is −14 degrees, the design temperature +1 degree).

Your local weather bureau will also provide another useful constant, your degree-days. One day carries as many degree-days as the mean temperature differs from 65 degrees. Total degree days, for the heating season, is the sum of these daily differences.

Example: If the mean temperature for December 21 is 35 degrees or 30 degrees less than 65 degrees, December 21 can be counted as 30 degree-days. Duluth, Minn., totals 9766 degree-days, Los Angeles, Calif., totals 1390 degree-days for the year.

The degree-day total for your area becomes important in calculating monthly and yearly kilowatt-hours.

We can now approach two basic electric heating formulas:

$C = H \times T \times 1.10$

$C$ — Maximum system capacity in Btu. per hour.

$H$ — Total heat loss in Btu. per hour per degree

$T$ — Maximum temperature difference between outside and inside temperature in degrees F.

1.10 — Allowance for pick-up.

$\frac{}{3413}$ = Kilowatts connected load.

This formula gives the system capacity required in kilowatts to meet the maximum expected heat requirements.

It cannot be too strongly emphasized at this stage in the development of electric heating that the system design must accommodate the maximum heating load under the most adverse conditions. The heating effect of a kilowatt is a very exact amount. There is no practical way to increase heating capacity, even for a short time, without adding kilowatts of heating equipment.

The next formula provides the annual consumption in kilowatt hours. Such analyses, though useful, should always be used with the understanding that they cannot be precise. Heating season requirements differ from year to year. Individual preferences in temperatures vary. So substantial deviations from estimated annual kilowatt hour requirements can be expected.

$A = H \times 24 \times DD.$

$A$ — Annual heat requirement in Btu.

$DD$ = Annual degree days.

$\frac{A}{3413}$ = Annual kilowatt hours.

Heat losses in a building depend upon the heat transmission characteristics of the building materials. Since the rate of heat conductivity of material can be determined experimentally, the total rate of heat transfer through a wall can be found if the nature and thickness of materials are known.

Tables of values in *Btu per square foot per degree F per hour* based upon an outside wind velocity of 15 miles per hour are available in heating handbooks such as the Heating, Ventilating and Air Conditioning Guide published by the American Society of Heating and Ventilating Engineers. Federal Housing Administration's Technical Bulletin No. 7 also contains similar sets of data. Such values are known as Coefficients of Transmission and are usually indicated by the symbol U. For example, a frame wall with wood shingles, sheathing, studs and plaster finish with full mineral wool insulation has a U factor of .076. Without the insulation it is .25.

In addition to heat losses through the walls, floor, and ceilings, air entering from outside must be heated to the prevailing inside temperature. Air enters through cracks around windows and doors and to a small degree through the walls. It may also be introduced through ducts for ventilation. Infiltration and ventilating air quantities must be estimated and heat requirements added to the losses through walls, floors and ceilings.

Heat losses through windows and doors are large. The U factor for single glazing is 1.13, for double glazing .45. Thus, storm windows or double glazing provides substantial savings in heat loss.

The function of the electric heating system is to provide comfort. To do so it must be designed to balance the heat losses in the most severe weather likely to be encountered. It is evident therefore that a reduction in heat loss has the same effect as an increase in the output of the heating system.

For electric heating systems, except in very mild climates, full insulation, double glazing, weather stripping and similar methods of reducing heat loss are particularly important. Our heat source is highly refined energy and relatively expensive. The carrying cost of good insulating methods is substantially less than the installed electric heating capacity and energy cost it offsets. In temperate to cold climates a good "rule of thumb" is to require wall, ceiling and floor U factors of not more than .10, glazing and door U factors of not more than .50.

### Radiation

Radiant electric heating systems are designed to give off a substantial amount of heat energy by radiation. The ultimate heating effect, however, is a combination of radiation, convection and conduction. All surfaces, objects, and the surrounding air tend to approach a mean temperature where heat energy and losses are in balance. Some authorities claim that comfort is achieved at lower air temperatures under radiant heating than with convection type heating systems. A part of this effect is due to reduced rates of air movement. This phenomenon offers practical possibilities for econ-

## By W. T. Stuart

omies in energy consumption. Available data, however, are not yet sufficiently compelling to justify lower system *capacities* on this basis.

Radiant heating systems involving large areas of low temperature are installed on room surfaces (Uskon systems, for instance, are installed as ceiling panels). In such installations it is important that backs of the panels are fully insulated from the adjoining space. If insulation is not provided, the heat energy from the panel will divide, reducing the heating capacity available to the space which the panels are intended to heat and adding to the heat capacity in the adjoining space.

The rate of heat transfer through a wall or ceiling is dependent upon the temperature difference of the inside and outside surface. If the inside surface is at panel temperature (about 110 degrees) the heat transfer must be calculated for that temperature rather than for the room temperature. This condition is illustrated in the accompanying example.

### *Typical Analysis*

To illustrate a typical method of calculating total system capacity and kilowatt-hour consumption, a simplified residence plan is used for the adjoining analysis. The house is a one-story frame house set on a concrete pad without basement and with blind unheated attic space. The layout is rectangular, 40 feet by 25 feet with 8 foot ceiling height. There are ten windows and two doors. Windows are equipped with storm sash and doors are double. Weather stripping holds infiltration of outside air to one complete change an hour. The required inside temperature is assumed to be 70 degrees for an outside temperature of 0 degrees.

It is assumed that good insulation and structural design gives ceiling and wall U factors of .08 and .10 for the floor.

*Step 1.* Each window is measured and the areas totalled. For windows with storm sash the U factor is .45. The temperature difference is 70 degrees. Multiplying these gives 4725 Btu. per hour for the heat loss through the glass area.

*Step 2.* Doors are measured and the areas totalled. The U factor in this case is also .45 and the temperature difference 70 degrees. The heat loss through the doors totals 1323 Btu. per hour.

*Step 3.* The total wall area is calculated giving 1040 square feet. Deducting the area of windows and doors leaves a net wall area of 848 square feet. Siding, sheathing, plaster board, plaster and mineral wool insulation has a U factor of .076 which is rounded for our example to .08. For a temperature difference of 70 degrees, the loss through walls totals 4749 Btu. per hour.

*Step 4.* The total floor area is 1000 square feet. The U factor is .10 and since there is no basement, the temperature difference is 70 degrees. The calculated heat loss is 7000 Btu. per

(*Continued on page 152*)

### EXAMPLE

1 story rectangular frame house
No basement, on concrete pad
Unheated, ventilated blind attic
North wall 40 feet
East wall 25 feet
Windows 8—3x5 with storm sash
1—6x5 with storm sash
Door, double thickness 2—7x3
Ceiling height 8 feet
Ceilings and walls are insulated with mineral wool, siding, sheathing, plaster board and plaster, giving a U factor of .08.
Floor is insulated to a U factor of .10.
Windows and doors have a U factor of .45.
Weatherstripping holds air infiltrations to one air change per hour.
Local design temperature is 0 degrees
Inside temperature required is 70 degrees
Local average degree-days is 500

**Total Heat Loss Analysis**

| | Area Sq. Ft. | U Factor | Temp. Diff. | Btu. Per Hr |
|---|---|---|---|---|
| Windows | | | | |
| 1—6x5 | 30 | | | |
| 8—3x5 | 120 | | | |
| Total glass | 150 | .45 | 70 | 4,725 |
| Doors | | | | |
| 2—3x7 | 42 | .45 | 70 | 1,323 |
| Walls | | | | |
| 2—8x25 EW | 400 | | | |
| 2—8x40 NS | 640 | | | |
| Total walls | 1,040 | | | |
| Less Window & Doors | 192 | | | |
| Net Wall Area | 848 | .08 | 70 | 4,749 |
| Floor 40x25 | 1,000 | .10 | 70 | 7,000 |
| Ceiling 40–25 | 1,000 | .08 | 110 | 8,880 |
| Infiltration | | | | |
| 8,000 cu. ft. per hr. | | .018 | .70 | 11,080 |
| Total heat loss | | | | 37,757 |
| Pick up factor 10% | | | | 3,776 |
| System capacity in Btu's | | | | 41,533 |
| System capacity in Kw. | | | | 12.2 |

**Annual Cost Analysis**

| | |
|---|---|
| Total heat loss in Btu. per hr | 37,757 |
| Divided by the temperature difference (70) gives | 539 |
| Hourly heat loss in Btu. per hr. per deg. times 24 (hours) gives | 12,936 |
| Btu. per degree-day times local degree-days (assumed 5,000) gives | 64,680,000 |
| Total annual Btu. divided by 3413 gives total annual kilowatt hours | 18,940 |

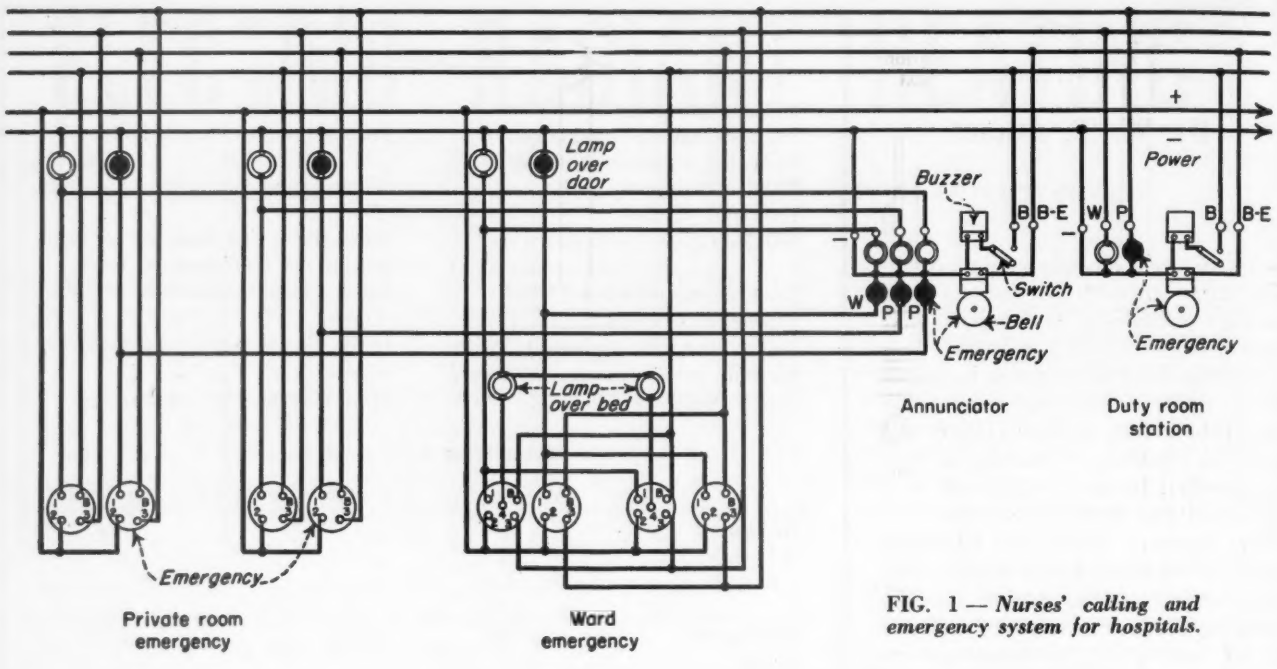



FIG. 1 — *Nurses' calling and emergency system for hospitals.*

# Emergency Signal Systems

**How to select equipment and lay out wiring for typical emergency call installations.**

EMERGENCY signal systems are used for the sole purpose of calling assistance, notifying those in charge of abnormal or dangerous situations and the prevention of costly or dangerous conditions from developing. Some of these systems are self-contained and control the entire situation and the final results. Other systems are combined with conventional calling and alarm systems in order to make them more effective. Still others initiate a series of steps which result in mechanical action or the control of remote electrical equipment.

A number of different applications which embody examples as to operation and their developments are outlined in this article. While only a relatively few systems are considered, they will undoubtedly initiate ideas after some study, and will be found useful in solving other and similar problems.

An emergency calling system for hospitals is shown in Fig. 1. This system is used almost exclusively in tubercular sanatoriums, maternity wards or rooms, certain observation rooms and other locations where emergency conditions may occasionally exist and where it is necessary to call assistance. It is used in conjunction with a nurses' calling system and is located on the same plate. The nurses' calling system when operated by the patient lights signal lamps at the bedside of the patient, or on the ceiling or wall above curtained enclosures if in a ward, above the patient's room door in the corridor, in the duty, utility and diet kitchen rooms and in the nurses' station. In addition, a buzzer is sounded momentarily at all supervisory points while the patient operates the calling station. All signals are cancelled by the nurse at the bedside of the patient. The emergency station contains similar operating equipment but is self-contained in the wall plate. It is only operated by the nurse, interne or other attendant and operates its own set of visual and audible signals. The operation of the emergency button or switch illuminates a separate and distinct colored lamp, green or red, in the previously mentioned door lamps, duty, utility and diet kitchens and in the nurses' station. The audible signal is generally in the form of a small bell which operates continuously until the emergency station has been reset.

A psychiatric hospital signal system for mental institutions, or such sections in general hospitals is shown in Fig. 2. This system is used in private rooms, wards, day or recreation rooms and is separate and distinct from any other signal system. Its function is to protect the nurses and attendants in the event of a threatened attack by the patients. A system of this type must obviously be designed so as to be practically fool-proof. It must be available to any of the nurses or attendants when required but the patients cannot use it. The system operates as follows: An attendant before entering an occupied room operates a control station in the corridor adjacent to the room door by means of a key. This action causes the room stations to become energized and also causes clear lamps to light above the patient's room door in the corridor, in the duty, utility and diet kitchen rooms and in the nurses' station. In addition, a buzzer is sounded momentarily at all supervisory points. In the event of a threatened attack while the attendant is in the room, the station is operated and this causes a colored lamp to light at all points where the clear lamps are illuminated. In addition an audible signal, usually in the form of a small bell operates continuously. All lamps and audible signals are cancelled by resetting the

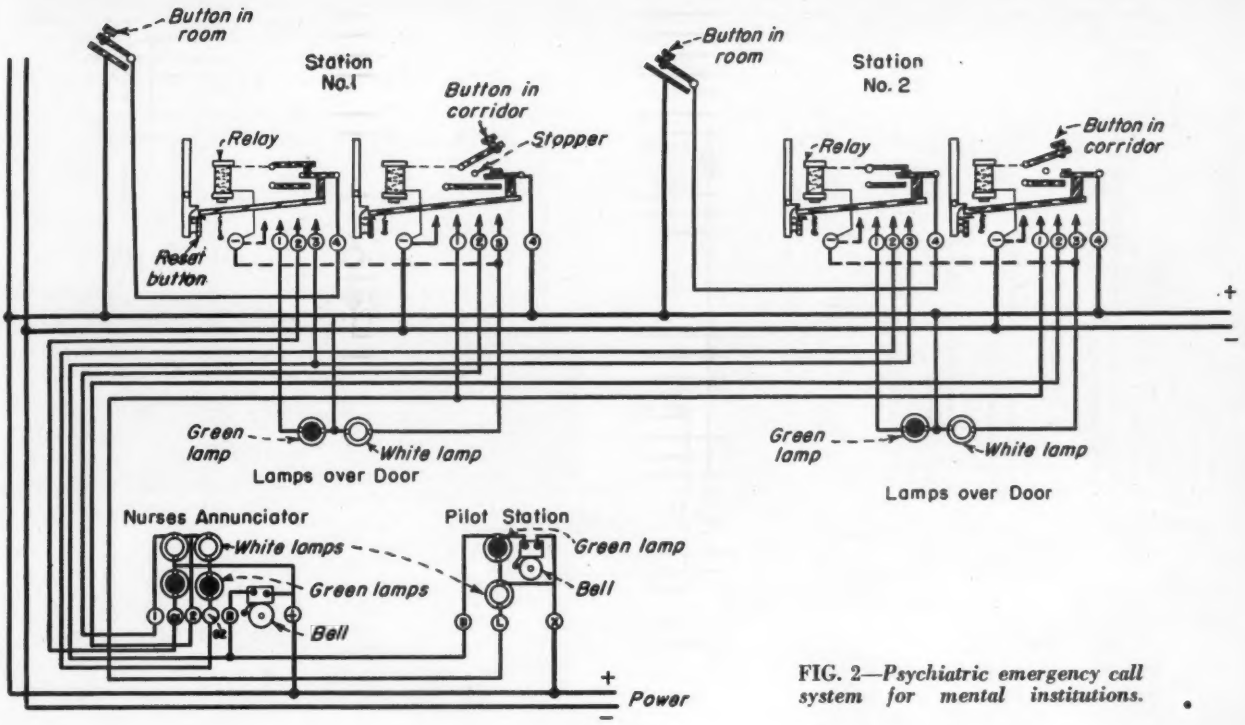



FIG. 2—*Psychiatric emergency call system for mental institutions.*

**By**

**A. A. Schuhler**

corridor control station adjacent to the patient's room.

Operating room emergency signal systems are used in major, minor and delivery operating rooms in hospitals. Their function is to call assistance when required. The stations in these rooms are similar to those used in the conventional nurses calling system except that they are modified so that they may be operated by the elbow or by foot, and are completely enclosed in explosion-proof housings. The operation of a station causes a colored lamp to illuminate above the operating room door on the corridor side and at a nurses' station assigned to that particular section of the floor. Frequently the visual signal is extended to a nearby nurses' station. Occasionally, in small buildings the visual signal is also extended to the regular nurses' call duty, utility and diet kitchen rooms as well as the nurses' station in the vicinity of the operating rooms. However, colored lamps or separate bullseyes are used at these points as a distinguishing signal. In addition, an audible signal in the form of a small bell is used as an audible signal which operates continuously until reset.

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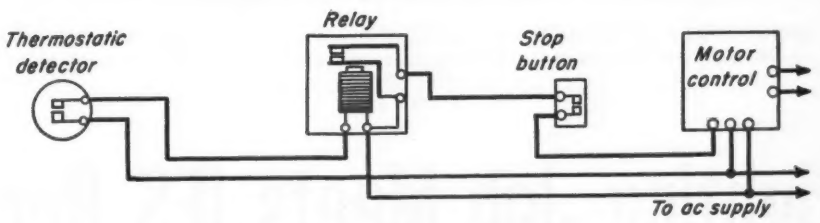



FIG. 3—*Blower control system for ducts.*

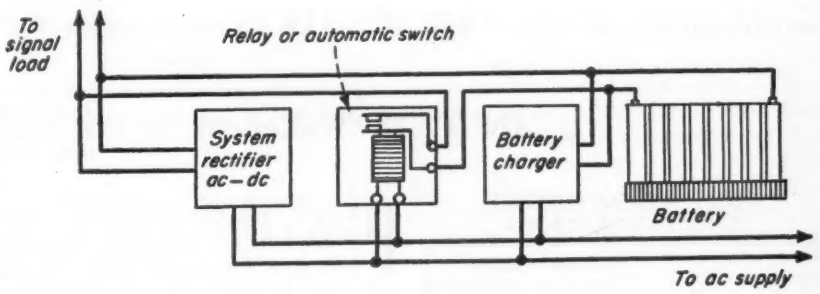



FIG. 4—*Stand-by current supply system for signals.*

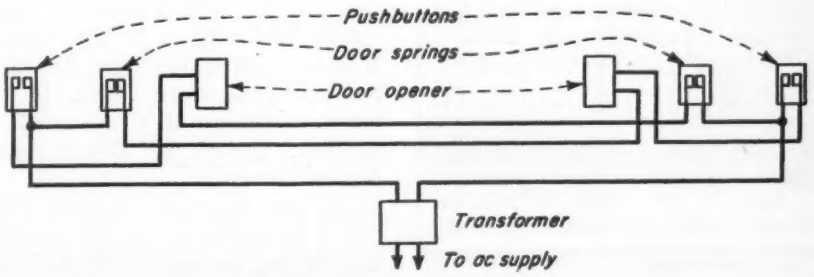
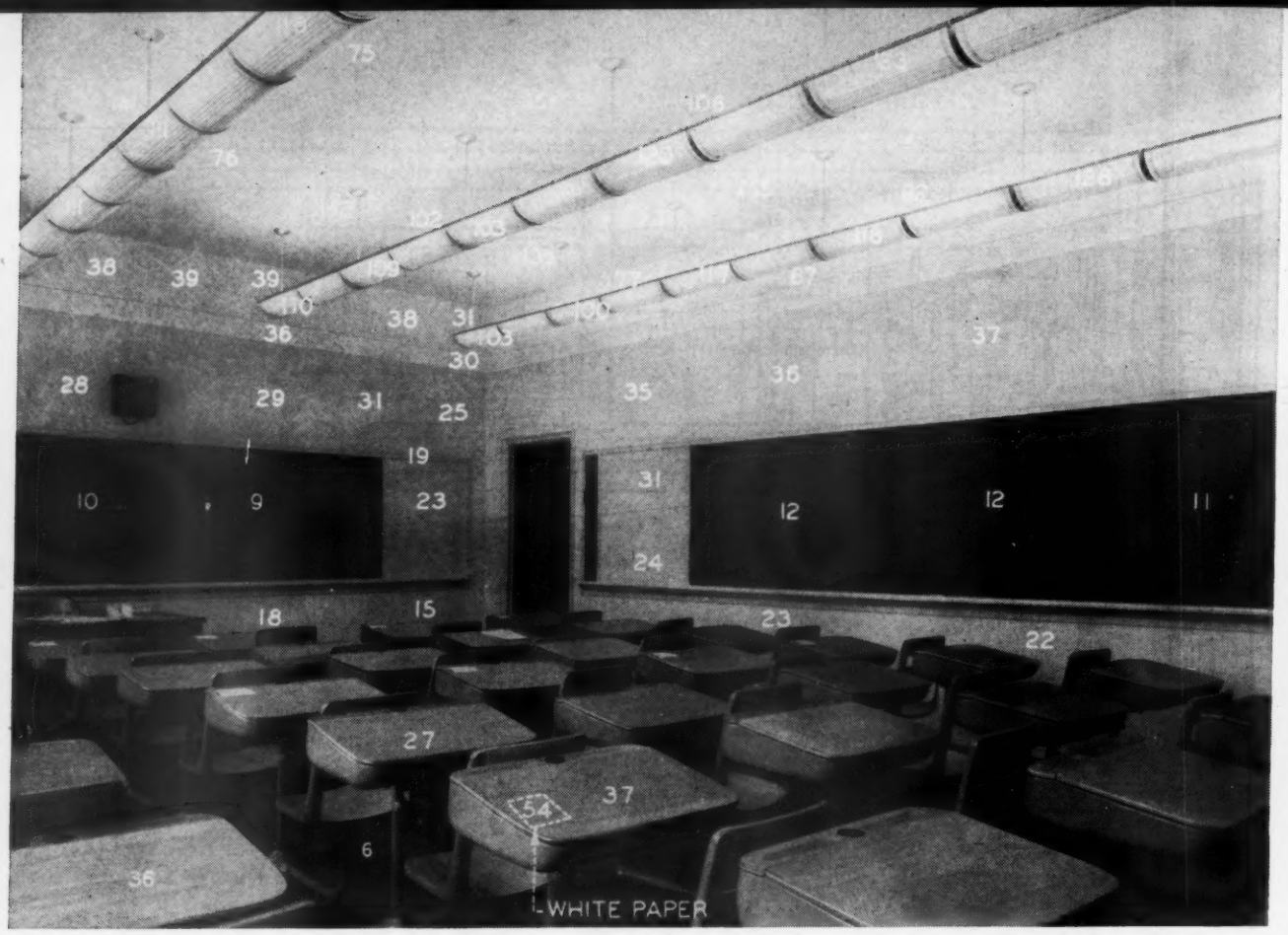



FIG. 5—*Door interlock system for laboratories.*




**BRIGHTNESS READINGS** *were made at 60 locations in seven-month-old classroom lighting installations for comparison with recommendations of new 1948 American Standard Practice for School Lighting.*

# Lighting Job Meets IES Recommendations

**Lighting system already installed in Mansfield, Ohio, school shows by test it meets requirements of new 1948 IES-AIA Recommended Practice for School Lighting.**

**By T. D. Wakefield** *Vice President, The F. W. Wakefield Brass Co., Vermilion, Ohio*

**TABLE I. ROOM SURFACE REFLECTION FACTORS**

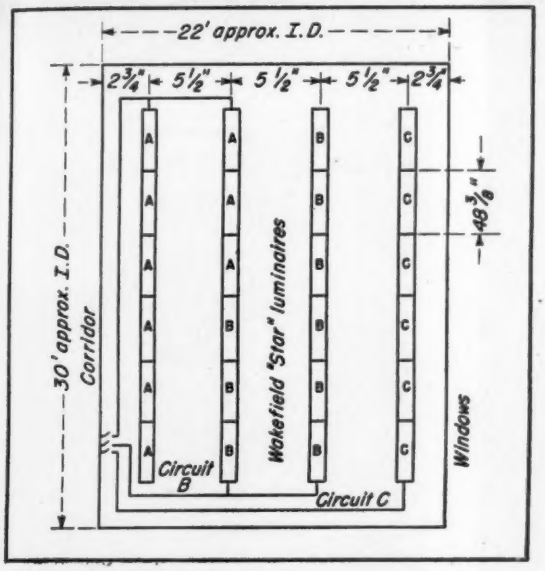
| Location | Classroom 101 R. F. in Percent | Recommendations | |
|---|---|---|---|
| | | American Standard Practice R. F. in Percent | National Council R. F. in Percent |
| Ceiling | Above85 | 80 to 85 | 85 |
| Walls | 62 to 70 | 50 to 70 | 50 min. |
| Trim | 48 | 30 to 40 | 40 to 60 |
| Tackboards | 67 | 50 to 60 | ——* |
| Chalkboards | 24** | 15 to 20 | 30 max. |
| Desk Tops | 30 to 55 *** | 35 to 50 | 30 to 40 |
| Floor | 22 | 15 to 30 | 30 to 40 |

* No recommendation.
** Boards covered with a light layer of white chalk.
*** Average—42%.

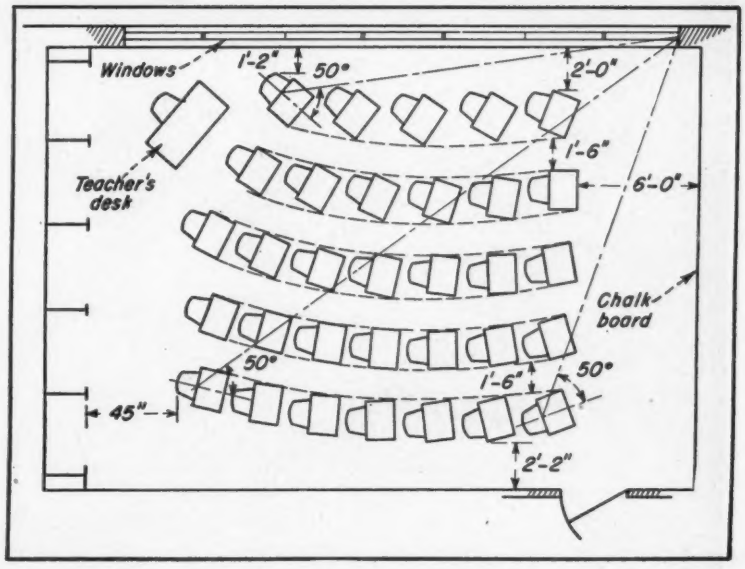
PROOF that the standards recommended in the new 1948 American Standard Practice for School Lighting can be attained and maintained with readily available lighting equipment and materials comes from a November 1948 survey by Russell C. Putnam. This survey was made of a classroom in John Simpson Jr. High School, Mansfield, Ohio. The room had been remodelled in April, 1948, to the recommendations of Dr. Darrell B. Harmon, Consulting Educationalist, Austin, Texas.

The new American Standard Practice is sponsored by the Illuminating Engineering Society and the American Institute of Architects, and has been approved by the American Standards Association, Inc. Russell C. Putnam, who made the survey, is a registered professional engineer, State of Ohio, and an independent consultant.

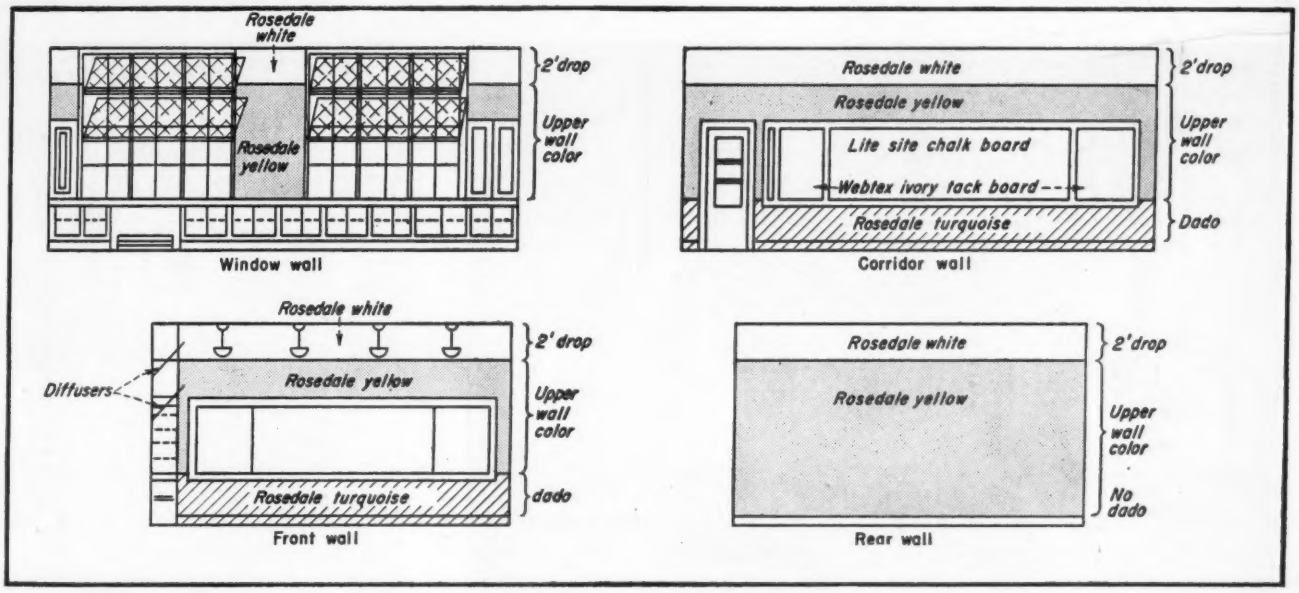
The rooms in question were completed in April, 1948, and no improvements or changes were made between April and late November. In Classroom 101, where the survey was made, one burned-out lamp was replaced. The room had the "usual" maintenance in the meantime. In other words, the lighting equipment had not been cleaned, the diffusers in the windows had not been dusted, and the pastel water emulsion paint used in decorating had not been touched up in any




LIGHTING LAYOUT *in Classroom 101, John Simpson Jr. High School, where test was conducted.*




*DESKS ARE LOCATED at 50 degree light angle as recommended by Dr. D. B. Harmon, Texas Consulting Educationalist.*




WALL ELEVATIONS *in Classroom 101, and colors used for painting. Ceiling was painted Rosedale white. (Luminall paint used).*

way. In spite of this the luminous indirect equipment held only three small particles showing as dark spots on the reflectors, and there were a few heel marks noted on the paint about six inches above the floor on the wall.

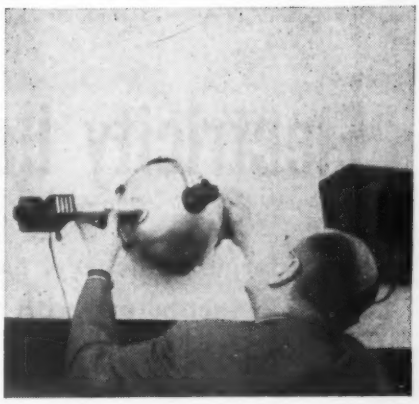
In April of 1948 the room had been redecorated and equipped with readily available paint, seating, chalk boards, lighting equipment, and daylight control in accordance with the Dr. Harmon recommendations. After Mr. Putnam had made brightness readings at 60 locations he reported as follows:

"The requirements as to artificial lighting of the American Standard Practice for School Lighting are all met satisfactorily, the ratios in all but one case being much better than the recommendations."

"All the ratios but one meet the recommendations of the National Council on Schoolhouse Construction. The one exception is the ratio of the brightness of the visual task to the brightness of the floor. This is specified in their guide as 1 to 1/5 or less, whereas the comparable ratio in Room 101 is 1 to 1/9."

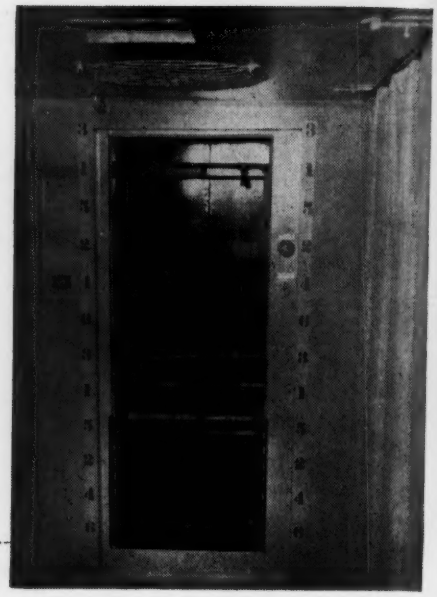
Using data from the test, it can be seen that in Classroom 101 the brightness difference in the surrounding field between the brightest and darkest surfaces was 18.5 to 1, against a value

(*Continued on page* 124)

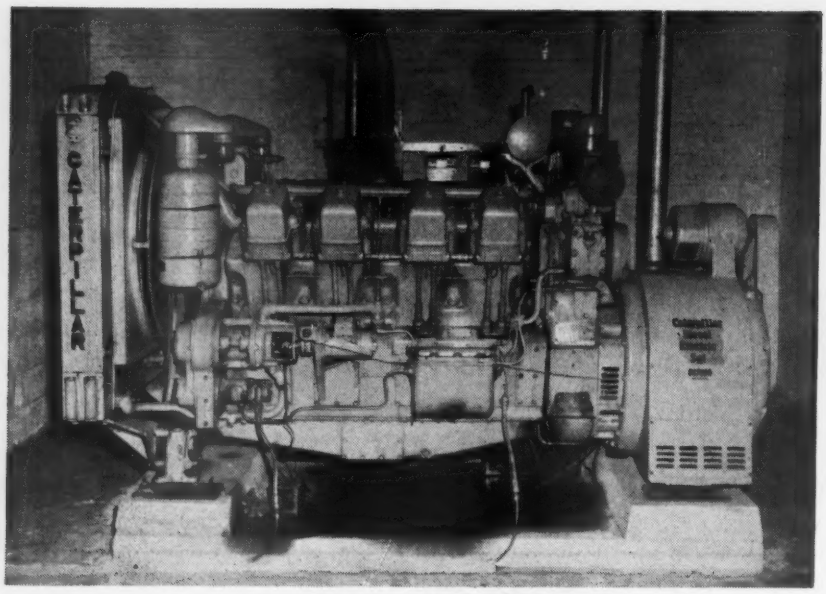


REFLECTION FACTORS *of classroom surfaces were made with a G. E. Reflectometer.*

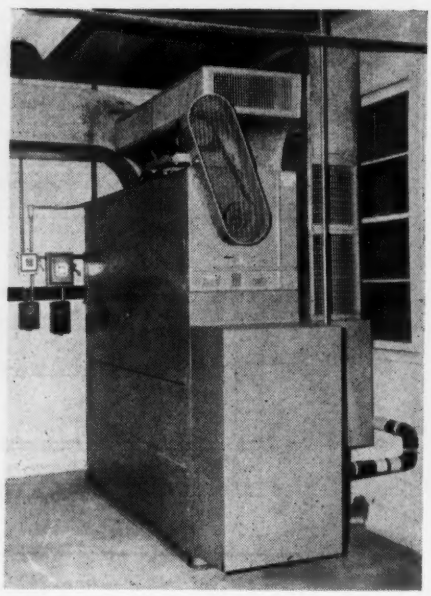
**1** *Part of 315-foot long battery of 30 Smith all-electric incubators, each with capacity of 78,620 chicken eggs, installed by The Morris Poultry Farm, Inc., at world's largest hatchery, Bishopville, Md.*



**2** *Two 2200-watt electric strip heaters and water spray nozzles for cooling and moisture control.*




**5** *100 kva. diesel electric set standby unit assures electric power and continuous operation of incubators in case of utility power failure. This installation guarantees maintenance of constant incubator temperature.*



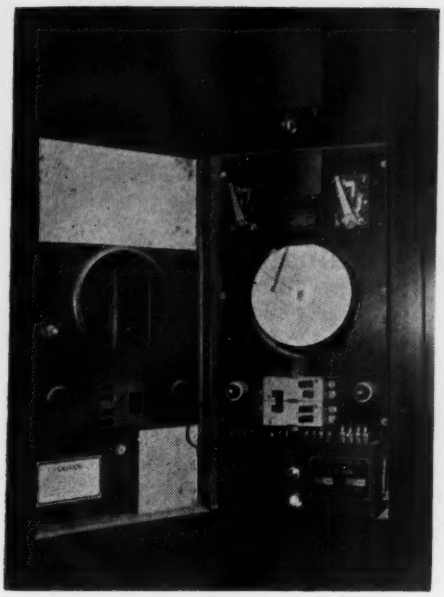
**6** *Air conditioning units maintain 75-degree temperature throughout the plant except within the incubator units.*

# Electricity Hatches Chicks

**World's largest hatchery, completely electrified, uses 30 all-electric incubators with capacity of over 40 million chicks annually.**

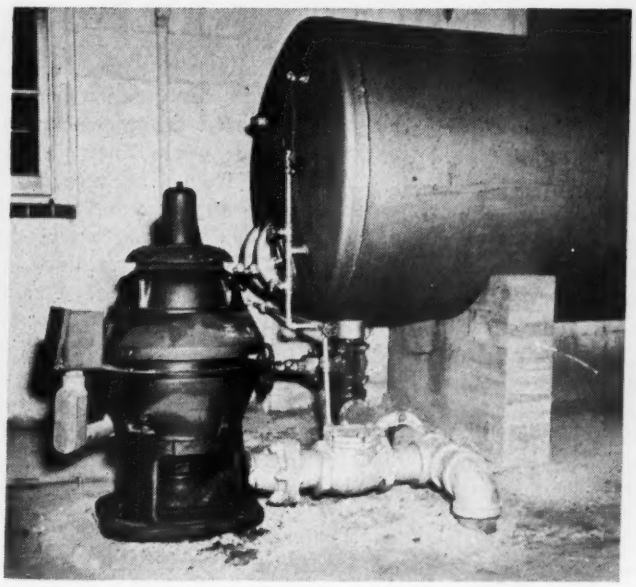
**By Ken J. Miller**
*Miller Electric Co.*
*Salisbury, Md.*

ELECTRICAL research and development hatches chicks at the world's largest chicken hatchery in the heart of the Del-Mar-Va Peninsula. The Morris Poultry Farm, Inc., located at Bishopville, Maryland, pipes in electrical energy over high tension lines, uses it to automatically heat more than two million chicken eggs simultaneously to a controlled temperature for a specified length of time and reaps a harvest of day-old chicks. How this electrical energy is distributed, controlled and otherwise made to do a better job of hatching eggs than even

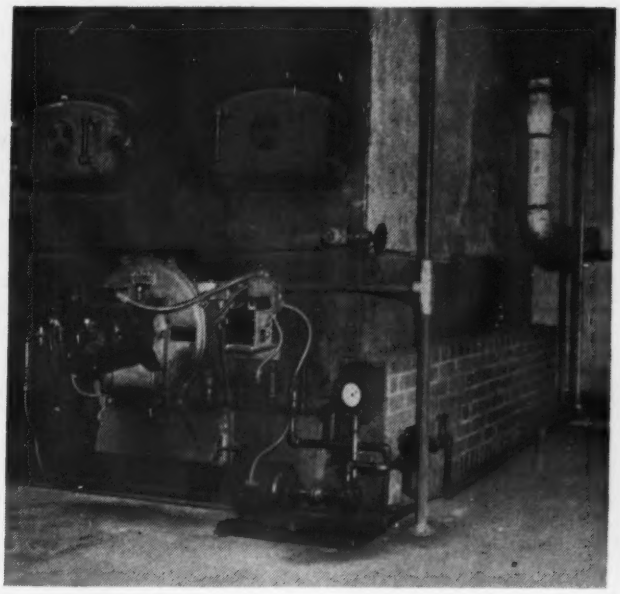


**3** *Temperature control chart, master switch and automatic controls are enclosed on front of each incubator.*

**4** *Electrical energy is supplied to plant at 120/208 volts, 3-phase, 4-wire. Three 400-amp. switches control branch feeders that carry current to local load centers in the huge hatchery.*



**7** *Water is supplied to plant from artesian well by 400 gallons per minute jet turbine pump powered by 15 hp. Fairbanks-Morse motor.*



**8** *Electricity powers oil burner hot water system and provides hot water for heating plant in winter, cleaning and general use throughout the plant.*

"old mother hen" can do is the story of this all-electric Maryland chicken hatchery.

Housing 30 incubators of the largest commercial size made, each with a capacity of 78,620 chicken eggs (or 58,320 turkey eggs), the Morris hatchery uses electricty for all power and control requirements. Power is supplied to the farm by the utility at 120/208 volts, three phase, four wire, through one-million-circular-mil cable between the utility transformers and the main switchboard. Here it is divided into three single-phase branch feeders and distributed to the various load centers in the plant.

Since uniform temperature is highly important in producing maximum hatches of highest quality chicks, and since as many as 2,358,600 eggs can be in process at one time when all incubators are operating at full capacity, no interruptions in electric service can be tolerated for more than a few minutes at any one time. As a guard against power failure on the utility lines, which would affect the temperature in the incubators and, if not restored within a reasonable time endanger all eggs in process of being hatched, a 100 kva. diesel electric generator set was installed as a standby unit.

Proper incubation and thorough sanitation, with precision control of temperature and humidity conditions, are also of prime importance in the hatchery business. These problems were solved at the Morris farm by installing all-electric incubators, with fully automatic control. These incubators are designed for easy maintenance and cleaning. Constructed of redwood

(*Continued on page* 124)

# COST of APPRENTICE TRAINING

**To be effective, apprentice training must be carefully planned and rigidly administered. This discussion evaluates the burdens and benefits of such a program.**


**By Ray Ashley**

*Research Engineer*
*Electrical Contractors*
*Association of City of Chicago*


APPRENTICE training is a growing institution and must continue to grow if electrical construction is to keep abreast with the demands of the time. It is a means whereby the public can reap the greatest benefits from the manpower expended.

In the previous article the cost of training electrical apprentices was discussed at length. Here, attention will be directed to the questions, "Who bears the burden?" and "Who benefits from the program?"

Two groups bear the burden of apprentice training:—*The organized electrical contractors* who foster training programs, and the *apprentices themselves.* The type of training which we have been discussing can only be realized by having carefully planned and rigidly administered schedules of instruction. It is a training intended to produce electricians adept in all lines of electrical construction work.

The mechanic engaged on new building work must, in addition to knowing how to install his own work, be able to:—

1. Read and interpret building construction plans.
2. Visualize the completed project.
3. Understand and anticipate the procedures and methods of other building trades.
4. Time work to fit the job progress and provide proper coordination with other trades.
5. Protect work during construction periods.

### *The Apprentice's Investment*

In order to master the school work and cope with other demands of a rigid course, the apprentice should have the equivalent of a high school education before entering the work.

The average age of the boys indentured, in normal times, is around 18 to 20 years. In localities where rates for mechanics are comparable to those used in the tables previously discussed, chances are that an 18-year-old boy with the equivalent of a high school education could start at $40.00 or more a week in most occupations. With a $5.00 a week raise each year, he would be getting $55.00 for the fourth year. His average salary would be $47.50 per week. The total salary for the first four years would be $9,880 (208 x 47.50). The electrical apprentice earns $9,380 for the four-year period. Using these modest figures for what he could *earn in other lines,* the amount he would have invested would be $500.00.

Any development of skills which provides for producing better work at lower costs, is an economic good and, as such, benefits society in general. Apprentice training is not only an economic good; it has become an economic necessity.

The buying public always gains by having skilled mechanics to do its work. The contractor risks his investment, and the apprentice his future. The public risks nothing and always benefits.

**APPRENTICE TRAINING** ***is essential if electrical construction technology is to go forward.***

One may say that the costs are passed on to the buyer. That is true to a certain extent, but in the end he gets value received and takes no gamble. In the past few years there has been an acute shortage of well trained electricians, and the buying public has found this shortage very costly.

As stated in the first article, apprentice training is the life blood of the business and cannot be neglected. The apprentice elects his vocation and, in majority of cases, follows a natural aptitude for the work. They provide essential skills from a background of well defined qualifications and training.

As contractors' appreciation of the benefits of apprentice training increases, their efforts to improve training programs also increase. In localities where contractors and the unions have formed joint training boards, both groups can benefit by having every graduate a certified man. A well planned and carefully administered program can serve as a guarantee on anyone completing the four-year course. The contractor, hiring such a man, will know he is securing someone suited to his work. The union, in turn, has its prestige raised by the high quality of such members.

For the apprentice the sign posts are optimistic for the mechanic engaged in electrical construction work. Many of the contractors, engineers, and estimators of today were the mechanics of yesterday.

Improved tools and construction equipment, together with improved and standardized materials, have greatly reduced the hardships and manual labor of electricians. In electrical construction work we regard the properly trained electrician of today as a specialized technician. All things considered, the future of the present day electrical apprentice looks bright.

# SHERARDUCT—
## THE *fortified* RIGID STEEL CONDUIT

SHERARDUCT is *fortified* against rust and corrosion by a zinc coating driven into the pores of all surfaces—inside, outside and *threads*. This coating is alloyed with the steel by the Sherardizing Process, and is an integral part of the tube itself.

SHERARDUCT is still further protected by the smooth "Shera-Solution" coating, baked on for added endurance against acids and other corrosive agents.

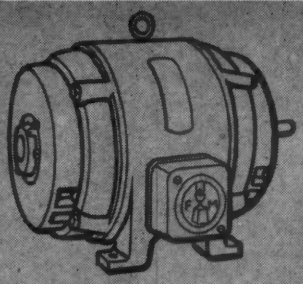
**SHERARDUCT will not crack or split! Bending does not harm the fortified protection, because the coating is an integral part of the steel itself!**

Specify SHERARDUCT—the *fortified*, full weight, threaded, rigid steel conduit. Sold through leading electrical wholesalers.

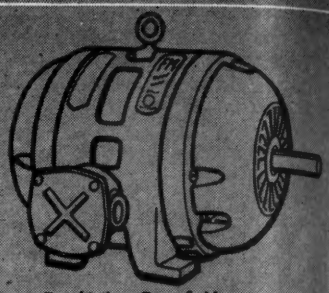
NATIONAL ELECTRIC PRODUCTS
WIRING 6 SYSTEMS
WIRES AND CABLES

**National Electric**
PRODUCTS CORPORATION
1301 CHAMBER OF COMMERCE BLDG., PITTSBURGH 19, PA.

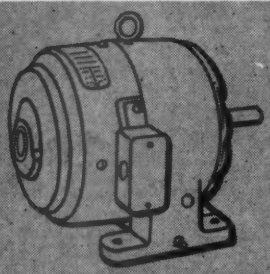
Vertical Motors



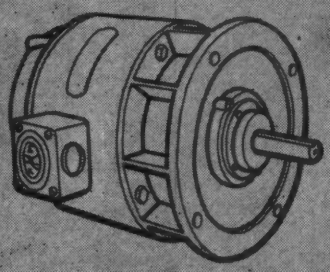
General-Purpose Ball-Bearing Motors



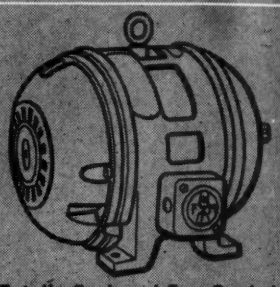
Explosion-Proof Motors



Motorgears

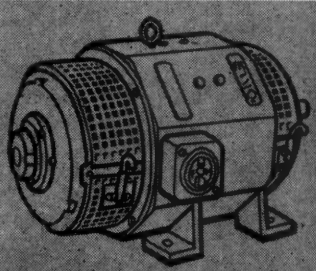


Flange-Mounted Motors



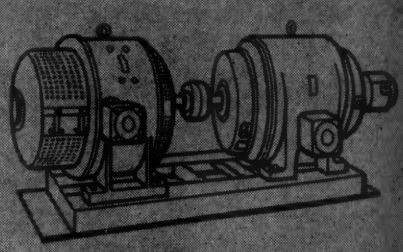
Totally Enclosed Fan Cooled

# *when it comes to Motors...*



D.C. Motors

You stand to gain much in dealing with your Fairbanks-Morse Branch or Dealer as the single source for *all* your electric motor requirements. Not the least are the benefits of undivided responsibility, unprejudiced advice and application assistance. For your copy of the handy "Pocket Panorama" which illustrates the complete line . . . write Fairbanks, Morse & Co., Chicago 5, Illinois.

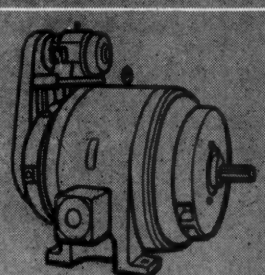


Motor Generator Sets

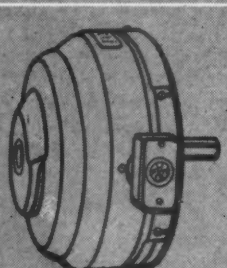
**FAIRBANKS-MORSE**

***A name worth remembering***

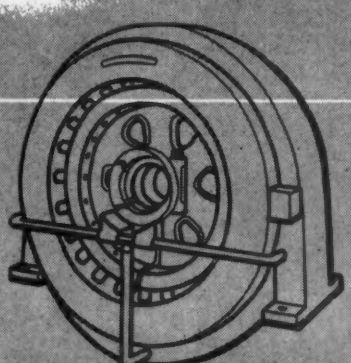
DIESEL LOCOMOTIVES • DIESEL ENGINES • PUMPS • SCALES • MOTORS • GENERATORS
STOKERS • RAILROAD MOTOR CARS and STANDPIPES • FARM EQUIPMENT • MAGNETOS



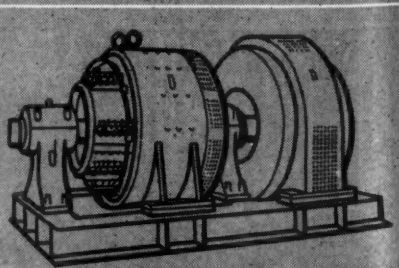
High-Speed A.C. Generators



Axial Air Gap Motors

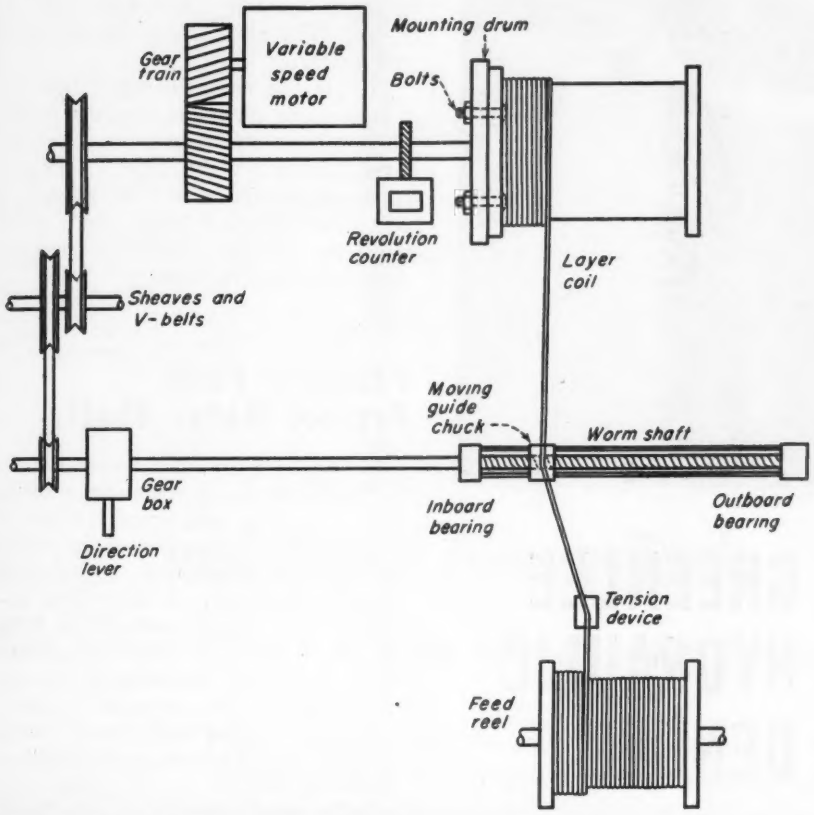


Low-Speed A.C. Generators

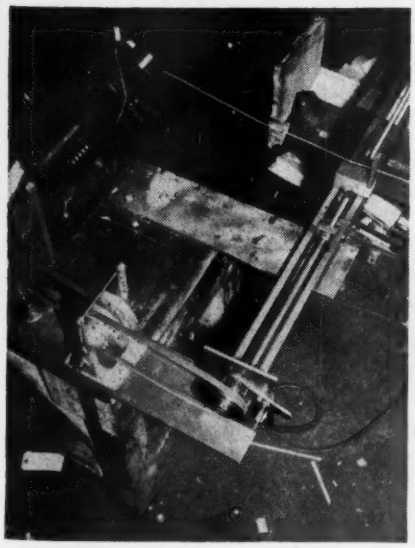


Frequency Changer

# Motor Shops




***Moving guide chuck slides back and forth along the threads of a worm shaft, maintaining wire from the feed reel always perpendicular to the layer coil being wound. Speed ratio of the two shafts is regulated by a train of sheaves and V-belts and direction of rotation of the worm shaft is controlled by a secondary gear box and direction lever.***



***Mounting drum has supported transformer segments weighing as much as 700 pounds. Moving guide chuck insures constant position of feed wire as it passes back and forth along travel of worm shaft.***

## Worm Drive Controls Layer Coil Feed

Layer-wound coils can be laid neatly, positively and rapidly in the shop of J. L. Hemphill, North Bergen, N. J., where the movement of wire back and forth across the coil frame is regulated by a simple device using the principle of the worm. The unit being wound is supported by bolts through the face of a shallow drum which is secured to the end of a horizontal, geared, motor-driven shaft.

Wire from a feed reel passes through a tension device and a moving guide chuck before reaching the unit being wound. A train of sheaves and V-belts connect the shaft supporting the unit being wound and the shaft supporting the moving guide chuck and, as this second shaft revolves, the guide chuck moves left or right along the threads of the worm shaft indicated in the accompanying drawing.

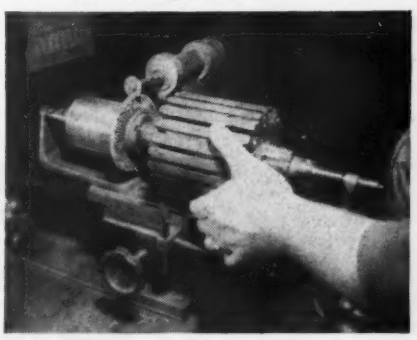
By varying the sizes of sheaves in the connecting pulley-belt linkage, the rotational speeds of the two shafts can be closely regulated and, by means of a gear box and a direction lever, the worm shaft can be made to turn either in the same or opposite direction to that of the motor-driven drum-supporting shaft. It is apparent, therefore, that the wire passing to the unit being wound can be maintained perpendicular at all times and, when a layer of wire has been completed, the direction of the next layer can be reversed by a touch of the direction lever on the secondary gear box.

The Hemphill Company finds that the device is particularly helpful in winding transformer cores and units up to 700 pounds have been wound on this machine. Manual attention is minimized, winding is speeded, coils are wound neatly and rapidly, and the position of the feed wire is positively regulated.

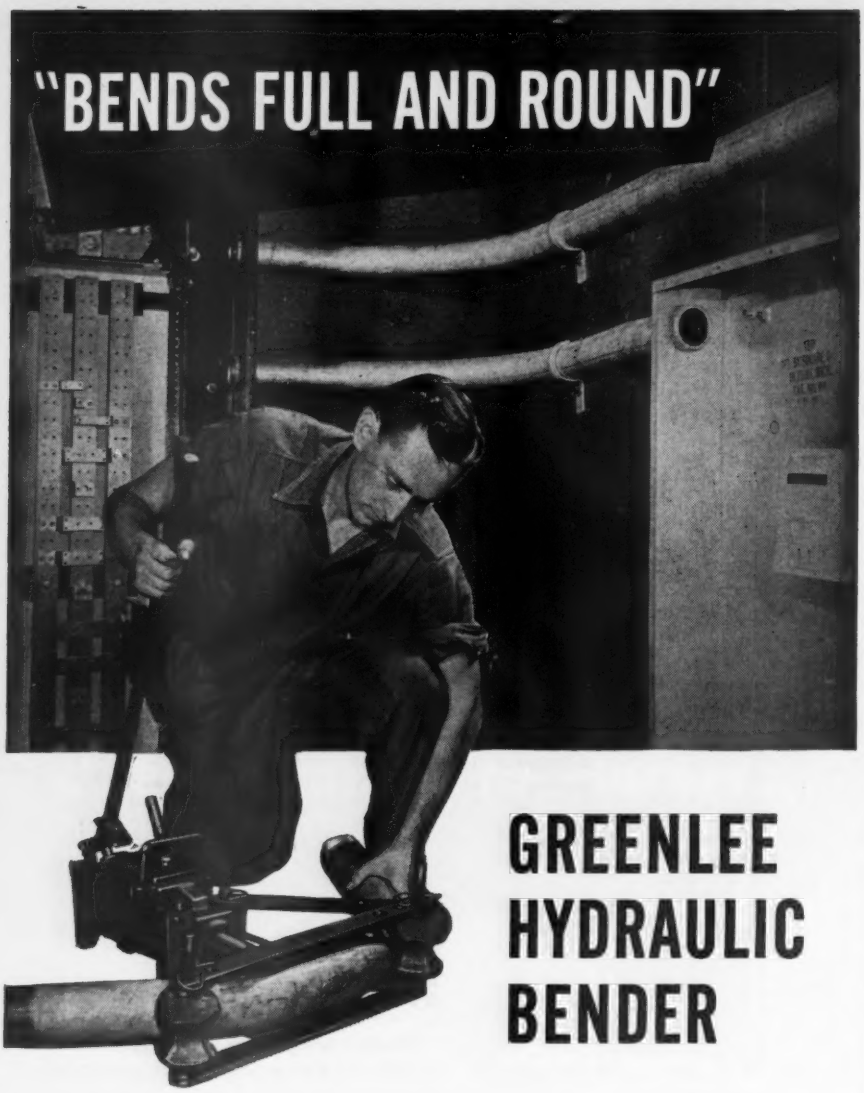
## Undercutter for Small Commutators

Commutator undercutting is done in a jiffy in the small motor repair department of the Giles Armature and Electric Works, Inc., Marion, Illinois. It takes only about two minutes to undercut a commutator face with the Hulhorst unit they use. Add another three minutes and the old coil ends can be milled out of the commutator lead bars (coils had been previously cut at the commutator and removed from the armature slots). Only additional adjustment necessary is to lower the armature carriage sufficiently to position the cutting tool.

The simple undercutter consists of



***Milling out old coil ends on commutator of a 4 hp., 250-volt d-c armature. By raising carriage of machine, commutator face can be undercut.***




# GREENLEE HYDRAULIC BENDER

Yes, on your conduit installations you, too, will find that the GREENLEE "bends full and round, with no flatness or uneven spots on the elbow or curve," just as reported by Papentuss Electric Co., LaCrosse, Wisconsin.

"And," continues this company's statement about their GREENLEE shown above, "It has been in service nearly 11 years. On the very first job it repaid its cost and has since paid for itself many times over! Its adaptability to the different conduit sizes makes bending a simple operation and brings about substantial labor and money savings."

Investigate the GREENLEE today. See how you, too, can make big savings . . . do the job faster, better.

The GREENLEE Hydraulic Bender is one-man-operated. Makes precise, neat bends in just a few minutes—in pipe up to 4½", rigid and *thin-wall* conduit, tubing, bus-bars. It's compact, portable, easy to set up and operate.

Get all the facts on this timesaving equipment, write for your copy of new tree Bender Booklet E-201. Greenlee Tool Co., Division of Greenlee Bros. & Co., 1750 Columbia Avenue, Rockford, Illinois.

TOOLS FOR CRAFTSMEN

GREENLEE

**OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK**

Hand Benders • Joist Borers • Cable Pullers • Radio Chassis Punches • Pipe Pushers

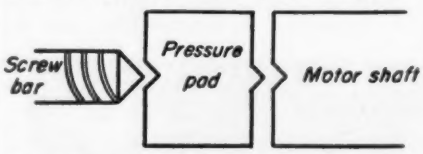

The simple undercutter consists of an adjustable carriage that holds the armature. A hand knob raises or lowers the carriage to the desired height for the proper groove depth; or for cleaning out lead bars. A hand lever on the opposite side moves the carriage back and forth as required. The cutting tool spindle is belt-driven at approximately 1200 rpm., by a ¼-hp., 1750 rpm., single-phase, 110-volt motor.

During the undercutting operation, the mechanic turns the armature with his left hand and moves the carriage lever with his right hand. Finished commutators are stored on an adjacent, tiered, wood block shelf with numerous vertical holes to accommodate the armature shafts.

## Pressure Pads Protect Motor Shafts

Motor shafts are often damaged during the process of removing pulleys with a pulling attachment. This is especially true if the point of the pulley puller screw is marred or damaged from frequent use. If the pulling attachment is slightly out of line with the motor shaft, the shaft center can easily be mashed or damaged on one side. This requires a recentering operation on the motor shaft center before the shaft can be turned or the commutator refinished.

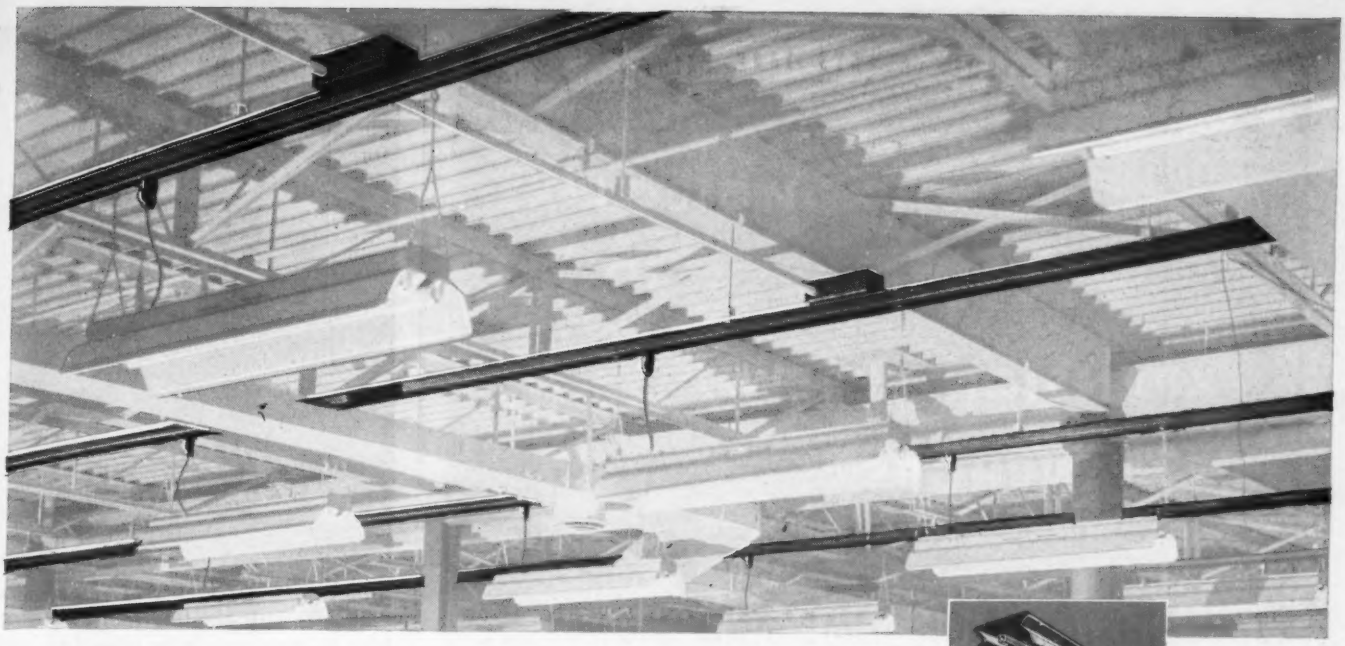
To prevent damage of this type, William Embree of the Arthur Wagner Company in Chicago designed a number of short steel "pressure pads"

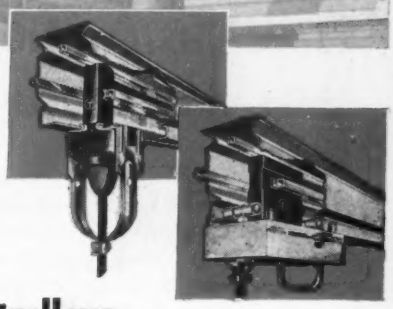



***Pressure pad between screw of pulley puller and motor shaft protects motor shaft center. Pads vary in diameter to match shaft sizes.***

that can be inserted between the motor shaft and puller screw. Entered in the 1948 NISA Award Contest, this shop idea is published through the courtesy of the 1948 Awards Committee of the NISA.

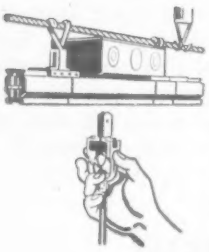
A number of pads are made from ordinary mild steel, with diameters ranging from ¼-inch up to 2 or 3 inches to match shaft diameters encountered in the repair work. Shop men are supplied with a set of these blocks and use them when pulleys must be removed from shafts. Result: Machinists in the Wagner organization no longer spend considerable time scraping motor shaft centers or recentering shafts.





# NOW... a Busway for Lighting and Small Power Tools

## New FLEX-A-POWER is every inch an outlet for plugs or trolleys



Now... Trumbull introduces the busway for 50 amp service—lighting, small tools, business machines, appliances. It's the LTG FLEX-A-POWER—an outgrowth of Trumbull's 20-year experience with the heavier FLEX-A-POWER used so successfully throughout industry.

### NO PRODUCTION BREAKS FOR RELOCATING LOAD OR RE-WIRING

Whether it's a run of ten feet or one thousand, LTG is a potential outlet every inch of the way. It can be instantly tapped by plug or trolley—*any place.*

The load can go where it's needed—not just where there's a fixed outlet—and without long extension cords.

### LOWER COST INSTALLATION—EASY RELOCATION

Prefabricated LTG sections are installed much more quickly than wiring and conduit. Systems can be dismantled and reinstalled—or extended—with ease and economy.

### MOST EFFICIENT PLUG-IN SYSTEM

*Exclusive*—plug or trolley can be inserted anywhere. *Exclusive*—no drop-out sections (which weaken system). *Exclusive*—two, three or four-pole systems in same compact housing. Each 10 foot length will support 250 lbs. at any point.

**NEW FREE BULLETIN TELLS** why LTG FLEX-A-POWER is less expensive, more practical than wiring and conduit... more flexible, more rugged than any other busway in its class. Send coupon now.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY
PLAINVILLE, CONN.

I want to know more about *savings* and *flexibility* with LTG FLEX-A-POWER. Please send Bulletin TEC-3.

Name.....

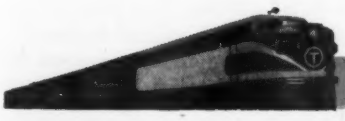
Company.....

Address.....

City.....Zone.....State.....

***Men Who Observe the Best Electrical Practice Make It a Practice to Use***

# TRUMBULL (T) ELECTRIC



TRUMBULL'S TRAINLOAD OF NEW PRODUCTS

THE BEST CRAFTSMEN ALWAYS TAKE PAINE'S...

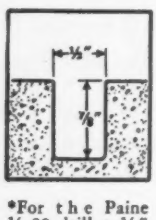
PAINE
EXPANSION SCREW
ANCHORS

PAINE
"900"

SAVE INSTALLATION TIME AND MONEY...
hold up to 10,000 lbs. in any Solid Material

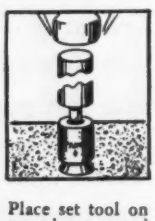
When you find it necessary to fasten objects such as machinery, shelving and electrical equipment to solid floors, walls and ceiling, you can save yourself time and trouble by using Paine Expansion Screw Anchors No. 900 (screws are not included). These anchors are quickly set in place to make a permanent anchorage that is capable of supporting up to 10,000 lbs., depending on the size used. They can be used in stone, marble, concrete or any other solid material. They are rust proofed and vibration resistant. A Setting Tool comes in every box. The anchors are stamped with size and thread of bolt or screw to use and have a directional arrow identifying which end goes in the hole.

Use a Paine Sudden Depth Rotary Drill bit for quick, accurate holes or, for the occasional user, use a Paine Hand Hammer Star Drill.




*For the Paine ¼-20 drill a ½" hole, at least ⅞" deep.

Place the anchor in the hole with the arrow on the anchor pointing down.



Place set tool on anchor and pound until anchor is set.

Screw the object to be anchored as tightly as possible.

*Dimensions in first illustration apply to Paine ¼-20 only.

THE PAINE COMPANY

2961 Carroll Avenue Chicago 12, Illinois

OTHER PRODUCTS

PAINE Anchors Flangers Superior Features BUILDERS SPECIALTIES

Spring Wing Toggle Bolts
Expansion Anchors
"Sudden Depth" Drills
Wood Screw Anchors
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WRITE FOR CATALOG

*Albert A. Diggles secures commutator segments with banding tool and metal tape in preparation to renewing mica V rings.*

## Banding Tool Has Use In Motor Shop

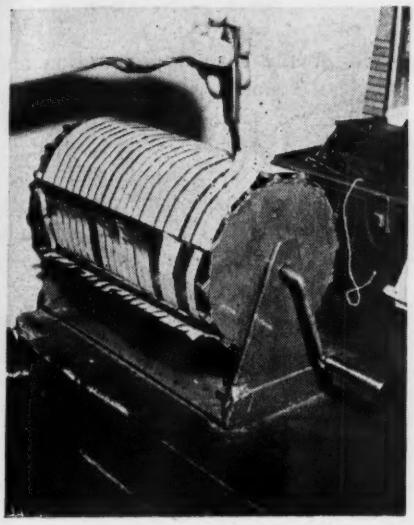
Inserting new mica V rings on a commutator can be facilitated if the commutator segments are held securely in their proper positions during this repair operation. And this condition can be maintained by binding the segments together with a metal band. In this connection, the J. L. Hemphill Company of North Bergen, N. J., finds that a banding tool, designed originally for crating operations, can be used to advantage for in a single movement, the band is drawn snug and secured.

## Tape Dispenser Cuts Coil Time

Mechanics in the motor repair shop of Lansing Electric Motors, Lansing, Michigan, have succeeded in slashing seconds from the time required to band together the numerous turns of wound coils. Scotch electrical tape is used for this purpose, but dispensing it was somewhat of a problem and frequently slowed up this phase of the coil making process.

Conventional dispensers did not seem to function to the satisfaction of the mechanics in the department. So they designed and built a "squirrel-cage" dispenser that met their requirements of gripping ease and quantities of pre-cut lengths.

The dispenser is in the shape of a 14½-inch long squirrel-cage rotated by a hand crank. The cage is constructed of two 7-inch diameter steel disks and separated by 16 steel bars (½-in. square stock) welded to the

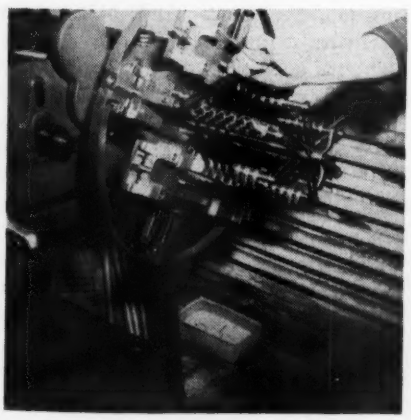


***Squirrel-cage dispenser provides quantities of pre-cut Scotch electrical tape for banding wound coils at Lansing Electric Motors repair shop.***

disk peripheries. Bars are spaced on approximately 1½-inch centers. A 16-in. by 5⅛-in. sheet steel base with triangular uprights support the squirrel-cage. A wing-bolt on one of the uprights acts as a "stop" to hold the cage stationary in any desired position. The complete assembly is securely bolted to the bench top.

Tape is wound around the cage in 24 separate bands (½-inch tape), each band being approximately 23 inches long. Individual lengths can be cut to any multiple of the 1½-inch distance between bars by simply running a knife blade along the proper bar. Only a few minutes are required to "load" the unit.

Prime advantages of this unique dispenser are: (1) Tape can be easily grasped by the mechanic (2) tape sections are in pre-cut lengths. Coils to be banded hang on arms extending from the work bench.



***Winding head in small motor department of Barker-Fowler Electric Company, Lansing, Michigan, puts knuckles in group wound coils. New unit (Potter-Rayfield) has lever attachment and split teeth that forms knuckles when lever is pulled.***

# PRECISION MANUFACTURED ENCLOSURES

*When you need Highest Quality at no extra cost insist on R&S throughout. Over 40 years of Design, Engineering and Construction experience is behind every R&S Product.*

Over the years R&S has pioneered in the development and standardization of precision-built control equipment in keeping with industries' expanding requirements of new processes and codes.

A large variety of standardized explosion-proof enclosures is available for grouping and assembly of control and power units in panel form, at minimum cost and without the usual delay of special designs.

R&S Standard Enclosures have wall sections permitting a great variety of conduit arrangements and sizes to suit job requirements. This simplifies material lists and reduces inventories caused by field changes.

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RUSSELL & STOLL COMPANY, INC.
*Precision-Built Electrical Equipment*
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## PREVENTIVE MAINTENANCE [FROM PAGE 47]

placed, the cause of the trouble is checked, and the cause is called to the attention of the night electrical crew by means of various colored stickers placed near the lower lip of the reflector where they can be readily spotted from the floor. This color code includes a red sticker to indicate a bad ballast, blue to indicate a broken socket, yellow denoting a grounded condition, and green to call attention to improper wiring. Since stickers can quickly be spotted and recognized from the floor, it is unnecessary for a man to again climb up to the fixture to verify the trouble, and the night-shift electrician can anticipate his required tools and parts before climbing the ladder; another practical time-saving procedure.

### *Starters and Ballasts*

At the present time, any repairs to a lighting assembly includes the routine changing of the starter, for the initially-installed combination starters and circuit breakers are now being replaced by Watchdog units for reasons of efficiency and reliability.

Another sidelight on the efficiency of this maintenance program is obtained by checking the ballast records, for only 100 units, out of a 9000-ballast total, have been replaced during the 6½-year period that the new building has been in operation, thanks to scheduled lamp replacement, immediate attention to abnormal conditions and the maintenance of rated voltages.

The success of this lighting maintenance program can be credited largely to the lighting maintenance engineer, Martin Madden, who, with two assistants, keeps accurate footcandle records for all plant and office areas and continuously inspects and checks lamps, sockets and ballasts.

Lighting maintenance, however, important as it is, is only one phase of the overall electrical maintenance program. For the complete electrical department employs 33 men (8 masters, 6 Class A's and 19 B's) under the supervision of electrical foreman Joseph Jantonio. He, together with the other foremen (in charge of welding, hydraulic, millwright maintenance, power generation, air and gas operation), reports to maintenance supervisor Otto Matousek and plant engineer Lester Wilson.

Electrical maintenance begins at service entrances and includes the periodic aligning and securing of all conduit systems, checking panelboards and switchgear, transformers, circuit breakers, control apparatus, underground wiring for parking lots and exterior walks, a-c and d-c motors.

Plant maintenance of motors covers all repairs except rewinding, with units requiring new coils being sent out to local motor repair shops. Since a representative stock of motors is kept on hand, damaged motors can be quickly replaced and, when the damaged unit has been repaired, it is placed in stock for rotational use whenever a motor of the same size and characteristics is removed from service. Motors are numbered as to type and size, and stored in sequence on shelves constructed for that purpose. Therefore, when any motor in the plant is taken from service, it is a matter of only a few minutes to phone the electrical department, report the location of the damaged motor, verify the type number, have a motor with the same number delivered to the trouble area, and effect the motor replacement. Since the location of every motor of each type is kept on file in the electrical department, it is unnecessary for motors to be visibly marked after they have been installed. Therefore, as soon as a motor is placed in operation, it is immediately painted in accordance with the established safety color code of the plant and the appearance of the manufacturing space is thus maintained constantly at peak levels. However, as soon as the unit is removed for repair, the type number is plainly painted on the base for rapid identification and accurate storage, and this number remains visible until it is again installed. In addition to this method for rapid and accurate typing, more complete information on the history, service and repairs of each unit is filed on separate cards in the maintenance supervisor's office so that recurrent faults can be spotted and checked for internal cause.

### *Plug-in Bus Duct*

As in most modern plants, considerable plug-in bus duct is used to carry power to utilization points with minimum voltage drop. Two breakers guard each circuit, one plugged in at the bus level and the other in the form of a disconnect at the individual machines. That the bus is overhead is not unusual, but the fact that the entire system was shifted from a sub-floor location to its present overhead position, without any shutdowns, speaks well for the careful preparation and efficient re-installation work by the plant's electrical department. With bus in the overhead, dirt, dust, damage and danger is minimized. However, regular inspections and maintenance periodically checks bus conditions, and ducts are thoroughly blown out with compressed air once a year to insure the absence of the lead and copper dust which is a natural by-product of bearing manufacturing.

Planned maintenance is evidenced also in stockrooms, engineering offices and shops in the plant.

A complete file of wiring plans, catalogs and equipment blue-prints are cross-indexed and kept on hand for reference in the supervisor's office.

All tools (including the large, heavy or special tools owned by the plant, and the small employee-owned hand category) are checked, repaired or replaced every three months.

Meters are stocked and used for all electrical checking; with ohmmeters, voltage testers, light meters, voltmeters and ammeters (both box-contained and clamp-on types) included in the company's stock.

### *Planned Maintenance*

Still another indication of planned maintenance efficiency and safety are observed in special scaffolding for high-bay maintenance and installation work, precautions enforced in connection with welding operations, the use of goggles and gloves wherever applicable, back-saving materials-handling equipment, and safety campaigns sponsored by the various departments.

The entire engineering division, comprehensive in its scope, constantly stresses preventive maintenance in every department. And, because preventive maintenance results in continuous operation of equipment at high efficiency, emergency work is an extreme rarity. For this reason, the numerical size of the division can safely be maintained beneath the personnel requirements normally found in comparable manufacturing plants.

Continuous and efficient operation of equipment, an enviable safety record, plant cleanliness, uniform high-level lighting, and routine inspections are all definite indications of a planned maintenance program; a program paying dividends in tangible profits.

*Don't Miss the New*
**READER SERVICE page 159**

Chalked up on the work slate above are a few of the many ways Wesco can help its electrical contractor and industrial customers. All these services and products, properly used, pay off in better production, reduced costs.

To these two big groups of Wesco customers, "production" has a different meaning.

"Production" to an electrical contractor means properly timed material deliveries, full use of manpower, airtight follow-through on orders by the electrical wholesaler, buying materials from one responsible source of supply.

"Production" to an industrial engineer means more units off the assembly line, fewer breakdowns in machinery, better use of power, a more efficient, satisfied work force.

Wesco stays on the job 24 hours a day, if necessary, to help its customers realize these definitions of production and thereby cut costs.

More and more electrical contractors and industrial plant engineers are finding out for themselves how Wesco P-C Service pushes *their* production—cuts *their* costs—helps *them* make money.

**Westinghouse Electric Supply Company**

*A National Distributing Organization with 109 Branch Offices*

TURN THE PAGE TO SEE HOW WESCO'S P-C (PUSH PRODUCTION CUT COST) SERVICE WORKS

# HERE'S HOW WESCO P-C SERVICE W

Only by pushing production to the hilt and paring costs to the bone can electrical contractors and industrial firms make money today. Wesco P-C Service is performed by a group of Electrical Sales Specialists whose one working incentive is to "deliver the goods" to Wesco customers with products and services.

These men work closely with electrical contractor customers in satisfying their requirements. The quality of Wesco products has long been taken for granted. Wesco delivers what they need, when they need it, where they need it from one convenient source of supply. This helps electrical contractors to get full manpower production on every job, realize maximum efficiency on closely figured contracts.

Wesco P-C Service works for industrial customers by cooperating with plant personnel to select and apply the proper electrical products that will satisfy a given problem and boost the productive level of men and machines. You can always call on the wide and varied experience of Wesco Sales Specialists. And before you make a single commitment, Wesco Sales Specialists will back every recommendation with case histories and figures to prove that the suggestions will produce the desired results.

## WESCO P-C SERVICE INTERPRETS THE NEEDS OF ELECTRICAL CONTRACTORS

Call Wesco in right at the beginning when you are setting up your progress schedule. Wesco can give you information on local codes and the application of apparatus that will apply to the particular job you are working on.

After you order, the Wesco Salesman follows through on your job. He helps keep labor costs down by scheduling deliveries to suit your pace. If you wish, Wesco can assemble all parts in one shipment or it can stagger deliveries to your work schedules. And when emergencies occur, Wesco can shorten the waiting time. Wesco has daily contacts in hundreds of cities with manufacturers who give special attention to rush orders. When you need stock items, your nearest Wesco branch can supply them, in most cases, right from stock.

Wesco P-C Service assures contractors an airtight flow and control of materials to the job. With deliveries paced to job progress, your time schedule can be maintained and should stay within your cost estimates.

Much credit for Wesco's ability to give P-C Service is due to the Wesco Suppliers whose messages appear on the following 40 pages. These nationally known and respected suppliers have learned from years of experience the value of fine products and good service. Wesco depends on these partners in business and their cooperation enables Wesco to carry out its enviable record in the electrical industry for unfailing quality and service.

Westinghouse Electric S

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C WORKS FOR YOU

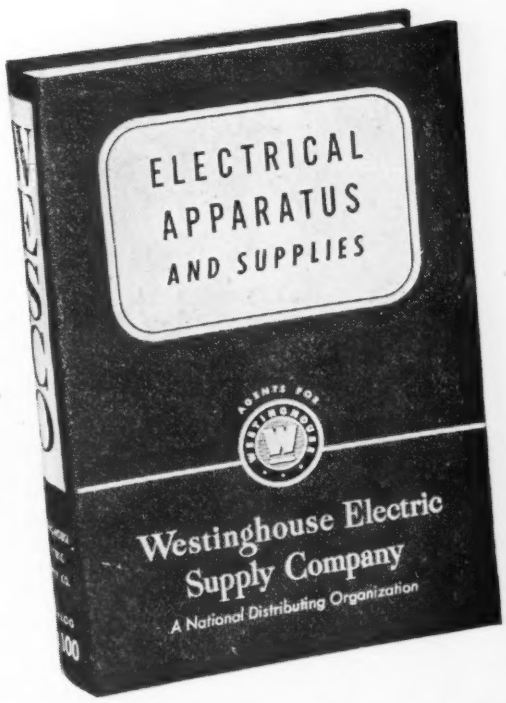
## WESCO P-C SERVICE COOPERATES CLOSELY WITH INDUSTRIAL CUSTOMERS

Wesco P-C Service brings you an experienced knowledge of things electrical. This knowledge is yours to use as you work to push production, cut costs, make money by adapting new electrical economies to your processes. Wesco Sales Specialists are quick in spotting proven ways to adapt products or methods to your problem.

Wesco P-C Service Specialists have had long experience in improving the working environment of your manpower. This is a vital factor in today's competitive market, because when people feel better, they work better. Workers are reluctant to leave comfortable surroundings. Wesco will be glad to make a free survey of your lighting, ventilation, heat and cooling problems.

One cards-on-the-table talk with a Wesco P-C Service Specialist may well result in more satisfactory plant morale.

## *New!* WESCO APPARATUS AND SUPPLIES CATALOG (TO APPEAR DECEMBER 1949)




Here is Wesco's up-to-the-minute catalog of electrical apparatus and supplies. It offers 896 pages of data, and price information on thousands of Wesco items. It's completely illustrated and contains much helpful data you can use every day. It simplifies the specifying and purchasing of all electrical materials.

Get your copy of Wesco's Apparatus and Supplies Catalog by placing your order with the nearest Wesco Branch listed on the last page of this insert. Or . . . fill out the coupon, mail it, and we'll send the book without obligation as soon as it is off the press.

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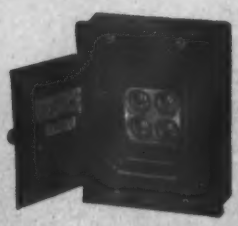

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Outdoor—Raintight
Service Switch

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## ELECTRIC SWITCH CORPORATION
Minerva Ohio.

## Sales Office and Factory at Minerva, Ohio

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AMERICAN Range Switches—dead front type—115-230 volts—non-interchangeable hot moulded bakelite main and range pull-out heads—taps for hot water and up to 12 fused branch lighting circuits.

AMERICAN General Purpose Switches—side operated—knife blade type—two and three wire—quick break—fused—30 to 1200 amperes.

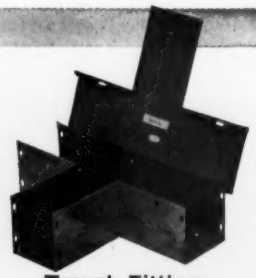
AMERICAN Meter-Switch-Fuse Sequence—front operated—toggle type—30 to 60 amperes—fused—2 to 12 branch circuit fuses—bell ringer transformer space optional.

AMERICAN Fuse Cabinets—Flush and Surface Mounting—2 to 24 circuit, 1 pole plug fuse branches—single phase, 3 wire and three phase 4 wire service.

AMERICAN Outdoor Meter Switches and Devices—side operated—knife blade type—weatherproof—for main line disconnect—standard hubs in top—quick break—fused—125 and 250 volts—2 and 3 poles—30 to 200 amperes.

AMERICAN Wiring Trough and Fittings—3 to 8 inches wide—3 to 8 inches deep—hinged or screw cover—trough fittings also are available.

Wiring Trough



Trough Fittings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# PROTECTION

ANACONDA
from mine to consumer
REG U.S. PAT OFF.

DENSHEATH, the Anaconda thermoplastic Type TW building wire, gives you the maximum in *protection.*

One of Densheath's important advantages is its protection against cutting and abrasion. Pull it hard over the sharp edge of an outlet box. The chances are you won't even dent the tough insulation. More protection: Densheath will not burn . . . is long aging . . . impervious to acids, oils and alkalis . . . has low moisture absorption.

Densheath protects profits, too: time is saved on the job by its special, slick finish for easy fishing . . . light weight for light work . . . permanent, bright colors for quick circuit identification . . . small diameter for more wires in a conduit.

Specify Densheath. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

*Reg. U. S. Pat. Off.

**THE DENSHEATH ADVANTAGE IN REWIRING WORK**

*3 #10 Wires* permitted in ½" conduit

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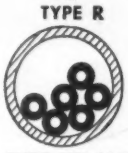

*6 #10 Wires* permitted in ½" conduit

**TYPE TW (ANACONDA DENSHEATH)**

National Electrical Code recognizes Densheath for circuits to 600 volts, temperatures to 140° F., and for wet and oily locations.

# Densheath*

## THERMOPLASTIC TYPE TW BUILDING WIRE

40480

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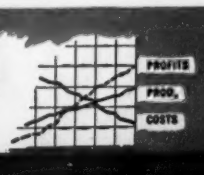

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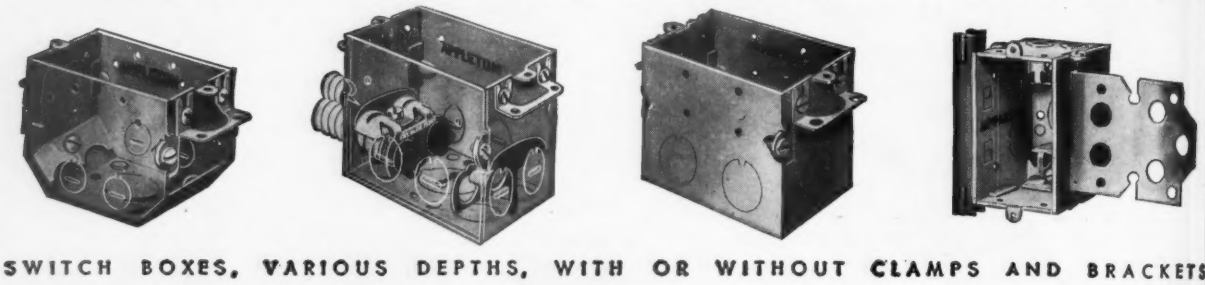

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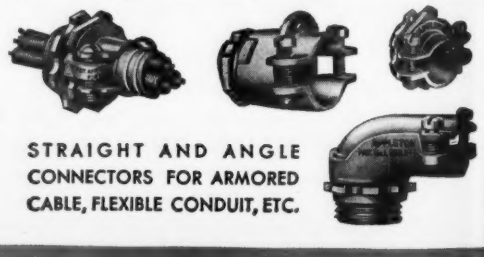

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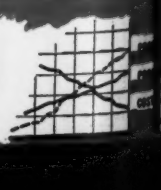

*For surest cable protection, specify—*

# BERMICO®

## FIBRE CONDUIT

## Scientifically Designed and Constructed to Provide Better Cable Protection, BERMICO *is always on the job!*

1 **LIGHT.** Easily handled on the job; one man can carry several 8-foot lengths at once—lay more per working hour.

2 **TIGHT.** All joints are precision milled for light, speedy, installations.

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8 **UNIFORM.** Four rigid factory inspections guarantee Bermico's uniformity of dimensions, specifications and quality.

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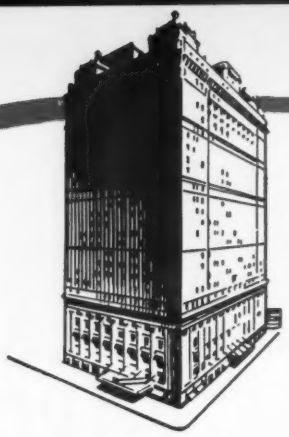

Hotel Book-Cadillac
Detroit, Michigan

# "We Completely Eliminated Excessive Heating in a Master Control Switch in Our Hotel"

"The 800 ampere renewable fuses, formerly used in the switch controlling a generator, gave us a lot of trouble due to excessive heating. This heating caused them to open 4 or 5 times a year.

"The problem was a serious one.

"On January 22, 1948, we replaced the fuses with 600 ampere Fusetron fuses. That was 15 months ago and to date not one Fusetron fuse has opened. The Fusetron fuses are operating very cool and have completely eliminated the excessive heating in the switch.

"We're certainly pleased about the ability of Fusetron fuses to hold in this installation."

John E. Nesmith, *Chief Electrician*,
HOTEL BOOK-CADILLAC
Detroit, Mich.

**When we Switched to.....**

## *Facts About FUSETRON Dual-Element FUSES*

The fuse link element opens on short-circuit — the thermal cutout element protects on overloads — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses — fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

# Use WESCO'S P-C Service for Profits

**PUSH PRODUCTION • CUT COSTS • MAKE MONEY**

# Fusetron DUAL-ELEMENT Fuses

with their

# 10 Point Protection

1. Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

## Stop Wasting Time and Money

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

**FUSETRON Dual-Element Fuses Give ALL-PURPOSE PROTECTION**

One needless shutdown — or one lost motor — or one destroyed switch or panel — may cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse.

Don't risk such losses — protect yourself by installing a FUSETRON dual-element fuse in every set of fuse clips throughout the entire electrical system.

(FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.)

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Please send me complete facts about FUSETRON dual-element Fuses.

*Name*_____

*Title*_____

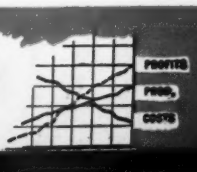
*Company*_____

*Address*_____

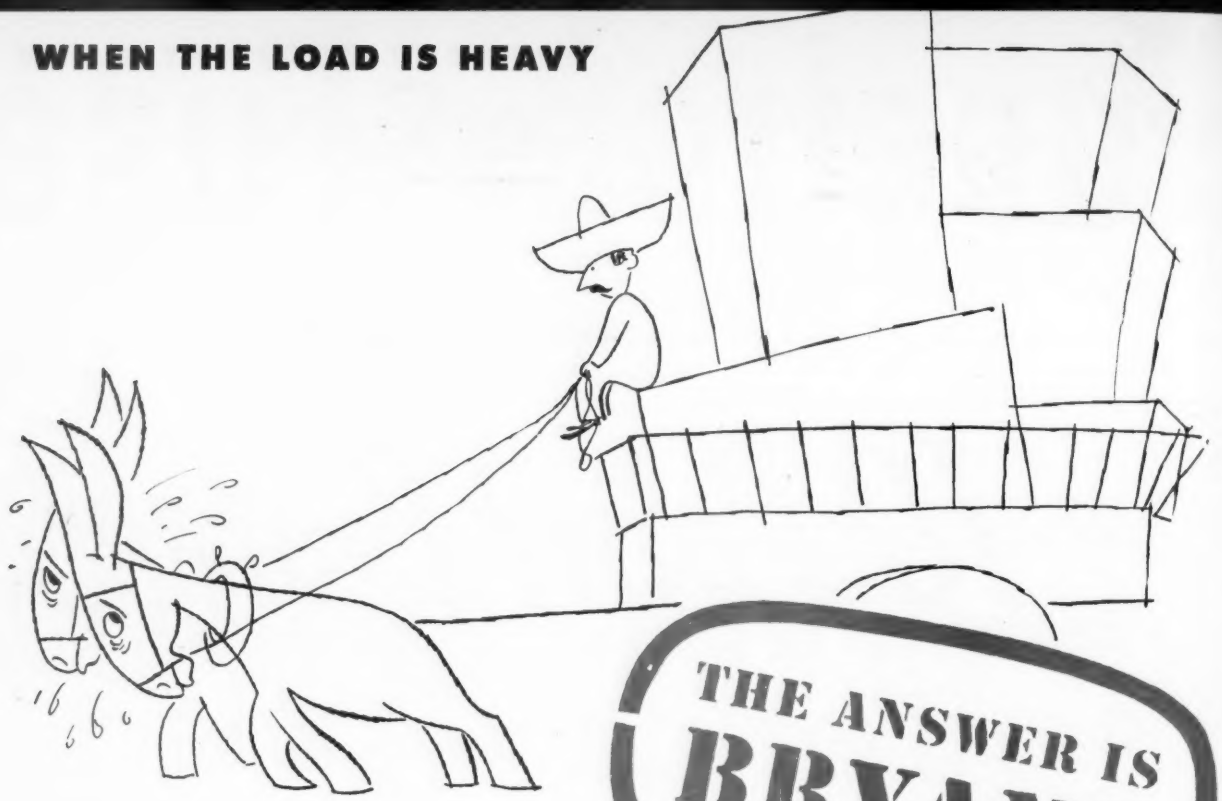
*City & Zone*_____ *State*____ EC&M 10-40

# Use WESCO'S P-C Service for Profits

**PUSH PRODUCTION • CUT COSTS • MAKE MONEY**



## WHEN THE LOAD IS HEAVY




## WITH BRYANT 5861 LINE OF 20 AMPERE FLUSH SWITCHES

These heavy duty switches are built for service in commercial, institutional and industrial installations where more severe loads are encountered.

Shallow cup, 1 1/32" deep, permits installation in conventional switch boxes.

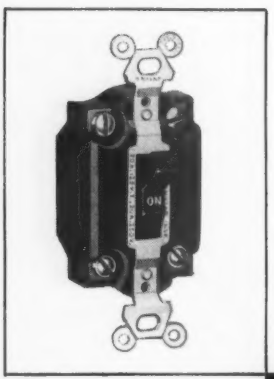
The mechanism is equipped with snuffers and is entirely enclosed in a rugged bakelite housing.

The washer type plaster ear yoke is insulated from the mechanism. Large, well-recessed binding screws permit easy wiring.

Available in single pole, double pole and three-way types with brown and ivory handles. Lock and momentary contact features can be furnished.

Meets all specifications.

Listed as standard by Underwriters' Laboratories, Inc.




J-99835

BRYANT
SUPERIOR WIRING DEVICES

**THE BRYANT ELECTRIC COMPANY**

**Bridgeport 2, Connecticut**

CHICAGO • LOS ANGELES

**SPECIFY BRYANT DEVICES FROM YOUR ELECTRICAL WHOLESALER**

# Use WESCO'S P-C Service for Profits

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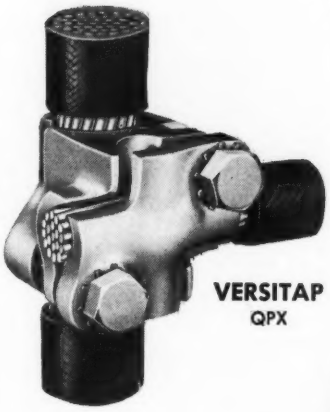
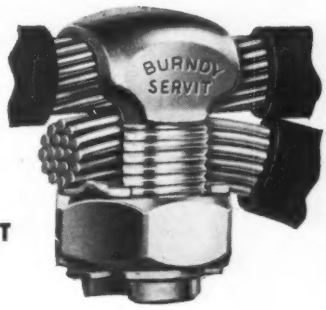
# You're Well Connected with BURNDY



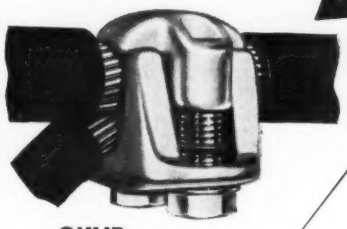
VERSITAP
QPX

QIKLUG
QA

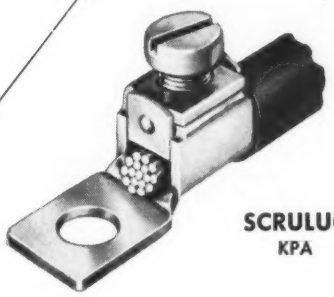



SERVIT
KS

## HERE'S WHY



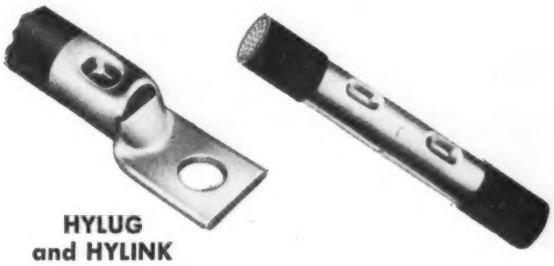
OKLIP
KVS



SCRULUG
KPA

They're designed with *you* in mind. Each connector, whether it be a tap, terminal or splice, is especially engineered for its specific job. Without fuss or fumble, each Burndy connector is installed quickly and simply. With a few sizes and types you can do almost any connecting job.

Because they are easier to work with and because they are both mechanically and electrically superior, Burndy connectors are preferred among contractors and industrial maintenance men. Catalog 52 completely describes Burndy connectors. You'll find it handy, so send for a copy today. When you're on the job, *connect with Burndy.*

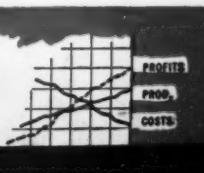


HYLUG
and HYLINK

**BURNDY ENGINEERING COMPANY, INC. • New York 54, N.Y.**

Use WESCO'S P-C Service for Profits

PUSH PRODUCTION • CUT COSTS • MAKE MONEY

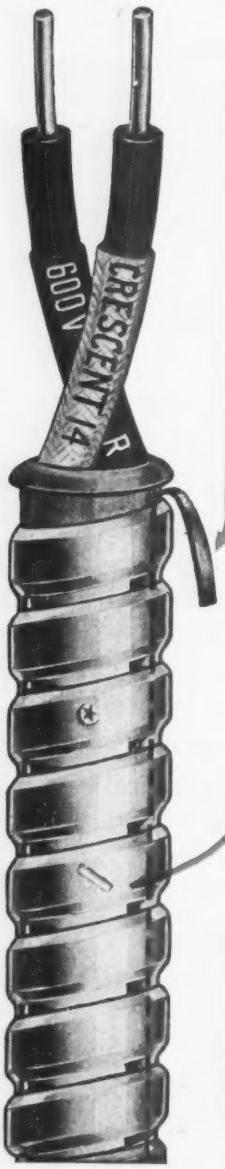


*Cut Costs with*

# CRESCENT
## A B C ARMORED CABLE

**These Improved Features Make Installation**

***Easier -- Quicker -- Safer***




### ★BOND WIRE UNDER ARMOR★

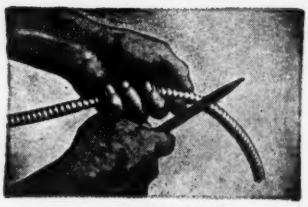
Sizes number 14 and 12 AWG employ a flattened bonding wire in contact with the underside of each convolution of the armor, assuring a PERMANENT LOW RESISTANCE of armor.

### ★PREFABRICATED BREAKING LINES★

At intervals of every 1½ inches on CRESCENT ABC Armored Cable you will find a small Cut Mark. This Cut Mark shows the location of a prefabricated breaking line *inside* the armor.

Only a few short strokes of a file or hacksaw guided by the Cut Mark are required to cut through ONE outer ridge, and a bend by hand severs the armor. By actual test, this saves 30% of the time ordinarily required. A clean separation results, with no sharp edge. There is no chance of injury to paper, conductor braid or insulation because only one OUTER ridge is cut.

The prefabricated breaking lines in the armor are so made that THERE IS NO REDUCTION of tensile strength, bending qualities, crushing resistance or electrical conductivity. This construction meets all requirements of Underwriters' Laboratories.


FILE OR SAW

BREAK

PULL OUT PAPER

INSERT BUSHING

To give you the *best in service*, Westinghouse Electric Supply Company has stocked *CRESCENT ABC Armored Cable* for many years.

## CRESCENT INSULATED WIRE & CABLE CO.

TRENTON, N. J.

OVER 60 YEARS EXPERIENCE

## Use WESCO'S P-C Service for Profits

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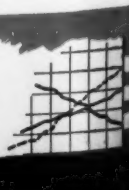

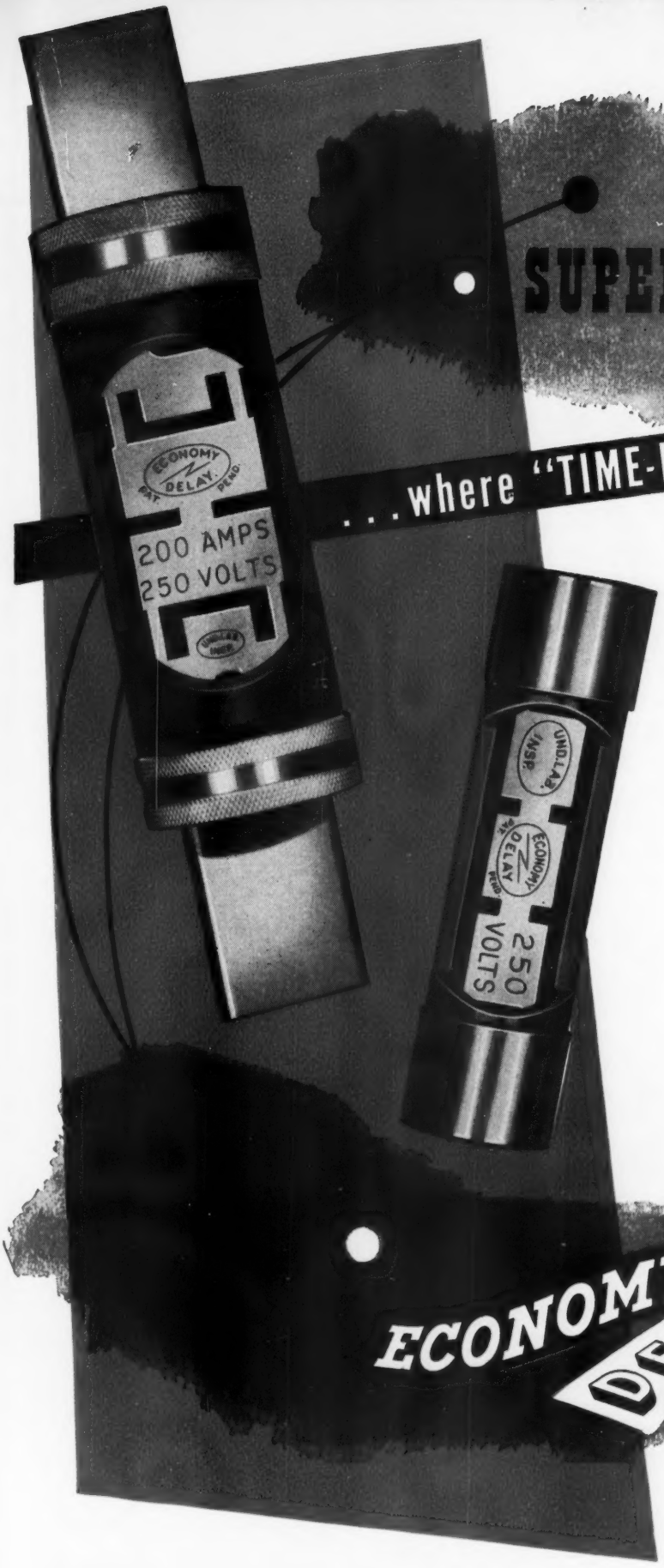


# SUPERIOR PROTECTION

## . . . where "TIME-DELAY" is needed most!

With a reputation for Pioneering and Constant Improvement, ECONOMY has always made its Renewable Fuses and Renewal Fuse Links to meet the *maximum* of all requirements of "The Standard for Fuses".

ECONOMY *"Time-Delay" Renewal Links*, now offer superior protection where time delay is needed most—within the 135% and 200% range in which most overloads occur.

Because of the simplicity and unusually fine mechanical construction of ECONOMY Fuses and *"Time-Delay"* Renewal Links, renewal is quick and easy.

See your Electrical Wholesaler for the new ECONOMY *"Time-Delay"* Fuses and Links; he has them in stock.

***SEND FOR NEW CATALOG***

**ECONOMY DE-LAY RENEWABLE CARTRIDGE FUSES**

B-2203RR

**ECONOMY FUSE AND MFG. CO.,** 2717 GREENVIEW AVE., CHICAGO 14, ILLINOIS REPRESENTATIVES IN ALL PRINCIPAL CITIES

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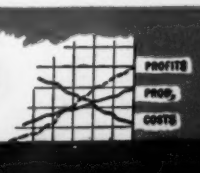
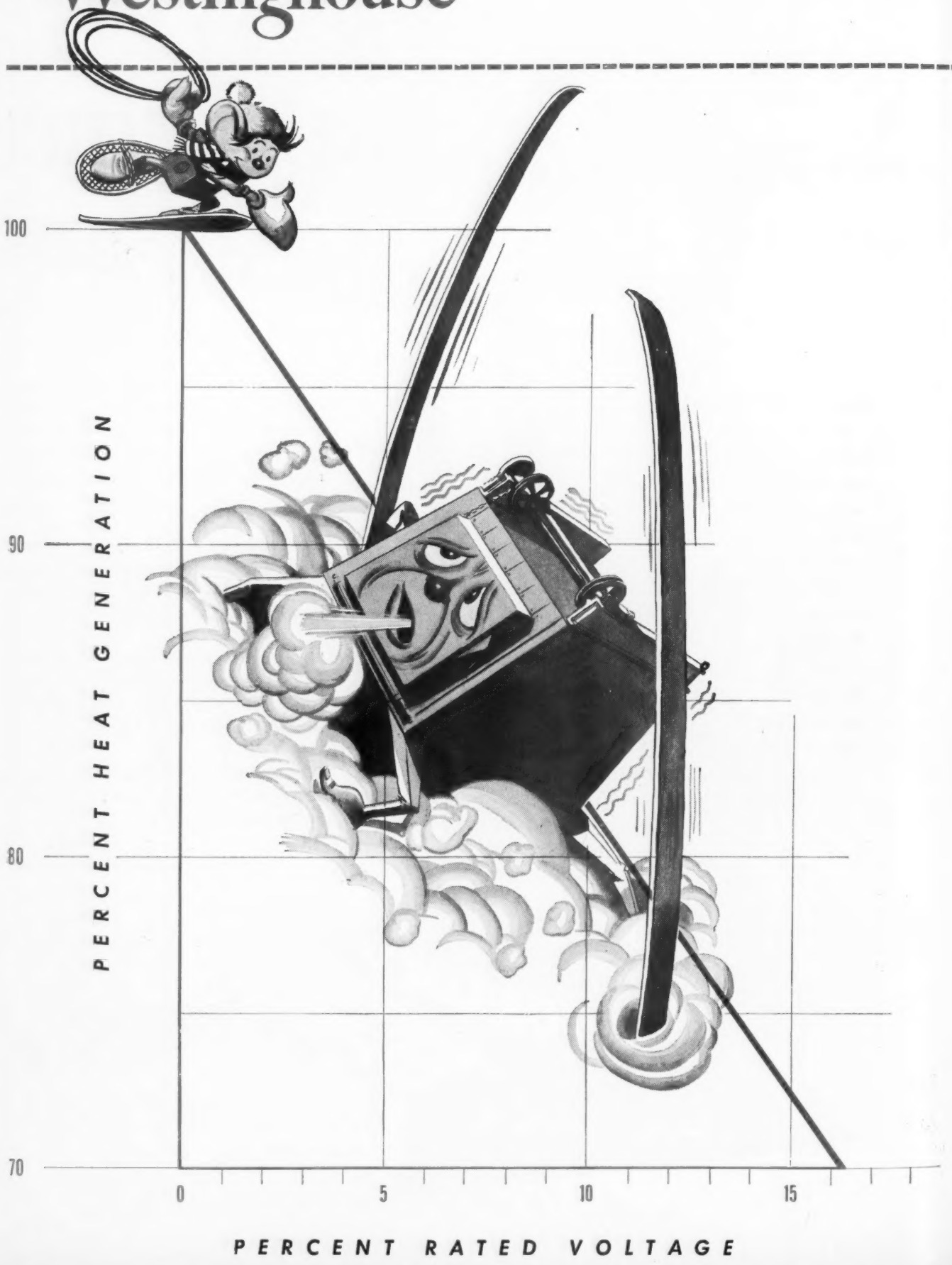
**PUSH PRODUCTION • CUT COSTS • MAKE MONEY**



YOU CAN BE SURE.. IF IT'S

Westinghouse




Use WESCO'S P-C Service for Profits

PUSH PRODUCTION • CUT COSTS • MAKE MONEY

# Apply the SURE CURE for Frigid Furnaces!

Slow to heat? Uneven temperatures?

When a well-designed resistance furnace fails to do its job quickly, efficiently, check first for these points: (1) Lengthy service wiring. (2) Overloaded circuit. Either means power loss. Correct this quickly, economically.

APPLY THE *SURE CURE.* Bring high-voltage power close to load centers with Westinghouse Dry-Type Transformers.

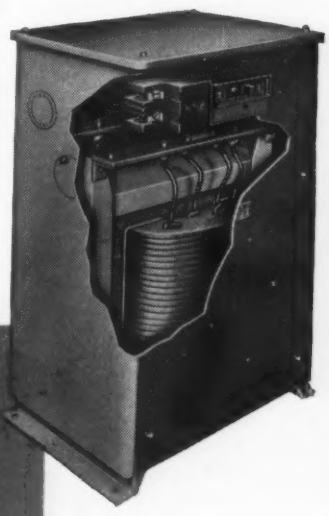
With long runs of secondary wiring, the power that should heat the furnace is wasted heating the line. Circuit overload causes an equally costly power drop. *A loss of 12% of rated voltage reduces heat generation to 77% of normal.* But taking high-voltage power close to secondary loads reduces voltage drop and minimizes power losses.

Because Westinghouse Dry-Type Transformers are smaller and lighter, they can be installed easily. There is no need for fireproof vaults—mount them overhead, on shelves, posts, or platforms. Welded sheet steel cases completely enclose the transformer for safety and a trim appearance.

You can be sure of effective correction of overloaded circuits and power losses with Westinghouse Dry-Type Transformers. For complete details, write for booklet B-4009. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70535

**NOW AVAILABLE WITH BUILT-IN CIRCUIT BREAKER**

New Types AJRB and AVRB give you a transformer and circuit breaker in a single, compact package. The need for separate protective devices is eliminated.



Westinghouse

DRY TYPE TRANSFORMERS

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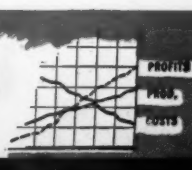


# CORRECT LIGHTING IS *fitted* TO THE PERSON ...TO THE JOB

The man at the bench needs concentrated light. The typist wants illumination over a greater spread. The lighting *you* might prefer would probably differ from that suitable for an inspector, draftsman or operator of a bookkeeping machine. How, then, can you provide efficient localized lighting for such varied conditions?

You'll find your answer in the Dazor *Floating* Lamp. For Dazor lighting is individually fitted to the user, to the job. Each employee gets *enough* light for clear, easy seeing . . . light that is *properly placed* to free eyes from the strain of shadows and glare. With no more effort than pointing a flashlight, the hand *floats* the Dazor reflector to any desired position. Held firmly by the patented Dazor *Floating* Arm, it stays until purposely shifted.

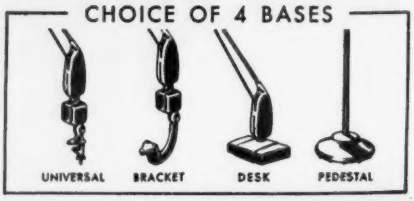
By installing this personalized lighting for precision work in shop or office you encourage higher production, curb errors and waste, promote well-being and safety. And note, please, that modern design makes the Dazor Lamp an *attractive* addition to your equipment.

Many shops and offices will also have a need for the Dazor *Floating* Magnifier (not illustrated). It contains in one unit both magnification and shadowless, fluorescent lighting. Ideal for inspecting, testing, fine assembly, toolrooms, machine shops, laboratories, first-aid rooms, photo retouchers, typographers, engravers, etc.

## DAZOR FLOATING LAMPS

FLUORESCENT and INCANDESCENT

CHOICE OF 4 BASES

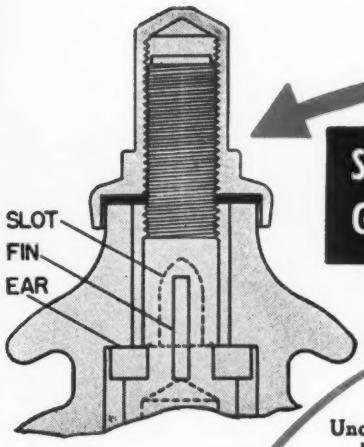


## Use WESCO'S P-C Service for Profits

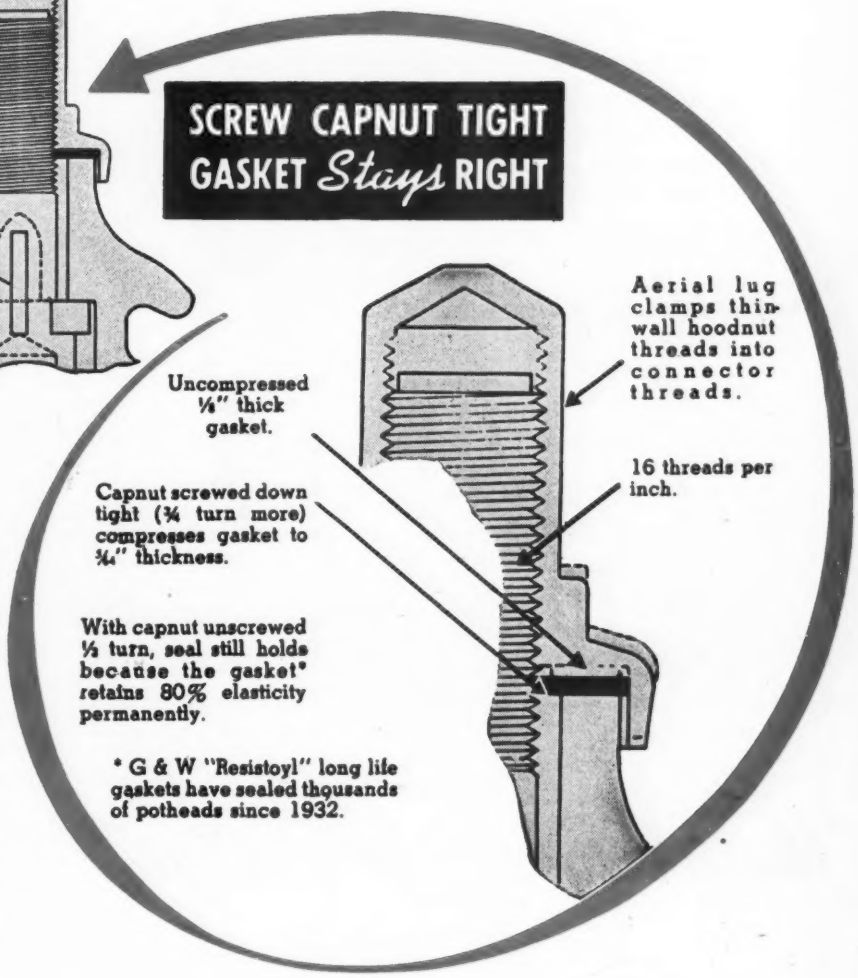
**PUSH PRODUCTION • CUT COSTS • MAKE MONEY**

# HERE'S THE SECRET

## OF THE PERMANENT SEAL IN G&W CAPNUT POTHEADS •




**SCREW CAPNUT TIGHT**
**GASKET *Stays* RIGHT**


Aerial lug clamps thin-wall hoodnut threads into connector threads.
Uncompressed ⅛" thick gasket.
16 threads per inch.
Capnut screwed down tight (¾ turn more) compresses gasket to ¼" thickness.
With capnut unscrewed ⅓ turn, seal still holds because the gasket* retains 80% elasticity permanently.
* G & W "Resistoyl" long life gaskets have sealed thousands of potheads since 1932.

**When installing the capnut terminal make sure that the connector fins are engaged in the slots in the bottleneck top of the porcelain. Also that the connector ears are seated properly up against the porcelain shoulder.**

**Use a large wrench for tightening the hoodnut on the connector. The porcelain will not break because it is under compression.**

**After hoodnut has been screwed down in contact with the gasket, tighten it another ¾ turn for a permanent seal. When so clamped, vibration cannot rotate the hoodnut the ½ turn which would be required to relieve gasket compression.**

G&W ELECTRIC CABLE DEVICES

## G&W ELECTRIC SPECIALTY CO.

7780 DANTE AVENUE — CHICAGO 19, ILLINOIS

*Also made in Canada by POWERLITE DEVICES, LTD., Toronto*

*Send for Bulletin "DIP"—Directions for Installing G&W Potheads*

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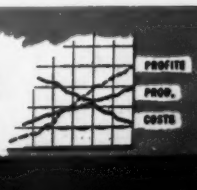
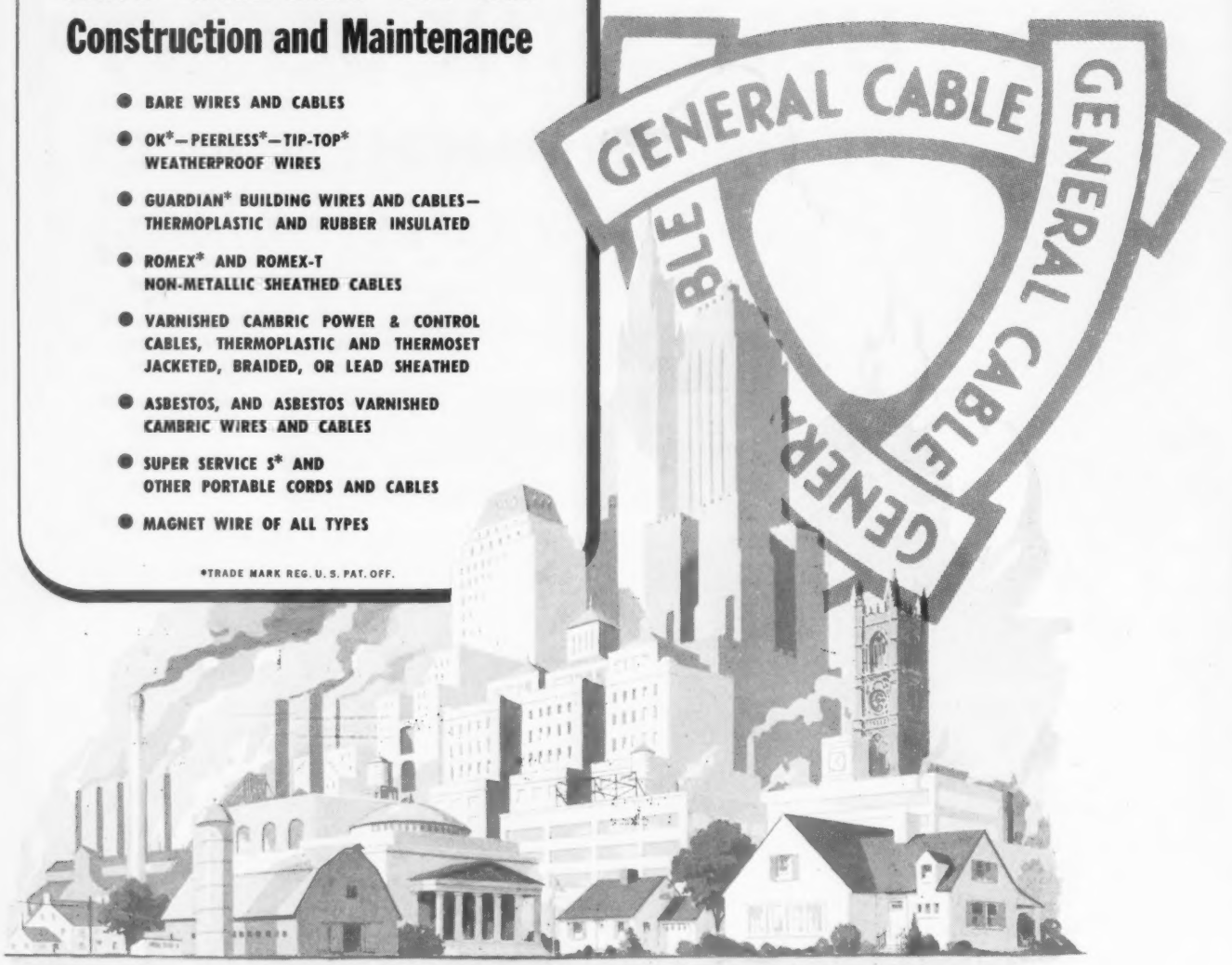


# ELECTRICAL WIRES AND CABLES for All Construction and Maintenance

- BARE WIRES AND CABLES
- OK*—PEERLESS*—TIP-TOP* WEATHERPROOF WIRES
- GUARDIAN* BUILDING WIRES AND CABLES—THERMOPLASTIC AND RUBBER INSULATED
- ROMEX* AND ROMEX-T NON-METALLIC SHEATHED CABLES
- VARNISHED CAMBRIC POWER & CONTROL CABLES, THERMOPLASTIC AND THERMOSET JACKETED, BRAIDED, OR LEAD SHEATHED
- ASBESTOS, AND ASBESTOS VARNISHED CAMBRIC WIRES AND CABLES
- SUPER SERVICE S* AND OTHER PORTABLE CORDS AND CABLES
- MAGNET WIRE OF ALL TYPES

*TRADE MARK REG. U. S. PAT. OFF.




## "More Power to You"

Yours is indeed a great combination—skill, planning, merchandising, purchasing, servicing. It is you who make the wheels go 'round, for us as well as yourselves. To facilitate your responsibility, we combine—the absolute best in wire and cable designs, utmost convenience in packaging, maintenance of ample stocks—with the channeling of distribution through your Supply Houses.

**GENERAL CABLE**
CORPORATION

OFFICES IN PRINCIPAL CITIES

## Use WESCO'S P-C Service for Profits

**PUSH PRODUCTION • CUT COSTS • MAKE MONEY**

# Thousands of Contractors Have Proved It!

# IDEAL Wire-Nuts®

THE SOLDERLESS, TAPELESS WIRE CONNECTORS

PATENTED—No. 1,933,555

NEW LOW PRICES

## are the simplest and best way to make approved wire joints

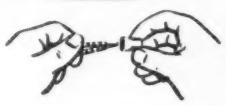
*Trade Mark Reg. U.S. Pat. Off.

**For more than 20 years leading electrical contractors have been doing better circuit and fixture wiring with "Wire-Nuts", the original mechanical type wire connector . . . Millions in use!**

There are at least *six reasons* why IDEAL "Wire-Nut" connections are preferred to all others. They are six reasons why, if you are not now using them, *you should be!*

- **Speed** — simply screw on — like a nut on a bolt! Connect any ordinary combination of wires from two No. 10 up to three No. 18 solid and/or stranded in just a few seconds. *Speed wiring changes*, additions and repairs, because they're easy to unscrew and use again. Simplify the adding of new circuits and making temporary connections. — no wires to cut, no short ends.
- **Cost** — "Wire-Nuts" are lower in cost and make each connection faster.
- **Ease of Use** — Eliminate use of tools required by other methods.
- **Safety** — A "Wire-Nut" connection is electrically SAFE, fully insulated — not affected by heat, cold or moisture.
- **Strength** — Cannot shake loose or pull out. Spiral spring insert twists wires and presses in the threads — holds with a vise-like grip.
- **Quality** — "Wire-Nuts" are made to highest precision standards . . . must pass pull-out (strength) test, resistance test, insulation test (2500V.) and weather tests.

Isn't it time you put all these advantages to work for you? Get a box of "Wire-Nuts" at your electrical wholesaler's TODAY . . . IDEAL INDUSTRIES, Inc., Sycamore, Illinois.



EASIER TO USE. Just screw on — that's all! No solder, tape or tools.

RESIST PULL-OUT. A "Wire-Nut" joint of two No. 14 wires will stand up to 176 pound pull.

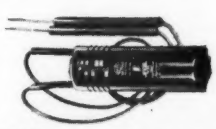
VIBRATION PROOF. Will not shake loose even under heavy vibration.

SAFE. Wire joint covered by plastic shell that prevents "grounds" and "shorts."

TOP QUALITY. Built to precision standards. Inspected and tested with laboratory care.

APPROVED. IDEAL "Wire-Nuts" are listed by Underwriters' Laboratories, Inc., and approved by other leading electrical authorities.

## ✓ And Don't Overlook These Other Tools That Cut Job Costs



**IDEAL VOLTAGE TESTER**
Not an ordinary "glo" type — actually indicates nominal line voltage from 110 to 600 volts — AC or DC. Solenoid indicator AND neon test lamp GIVE DOUBLE PROTECTION. Includes carrying case.

**NEW "Stripmaster" WIRE STRIPPER**
New, revolutionary design with "one squeeze" operation. Exclusive, automatic feature holds jaw open while wire is removed — positively prevents crushing of stranded wire. Sizes for all wire, 8 to 22.

**B-X ARMOR CUTTER**
Just snip—that's all! Cuts two or three-wire No. 10, No. 12 or No. 14 cable armor. Cuts anywhere along length of cable for opening into junction boxes, etc. Cutting blade removable for sharpening.

**NEW IDEAL "Coil-Flex" FISH TAPE**
"Spring-type" — speeds wire pulling in all kinds of conduit. Round surface minimizes slide resistance.
"Flat-type" Fish Tape and Reels also available in popular sizes.

IDEAL

• IDEAL INDUSTRIES, Inc., Sycamore, Illinois

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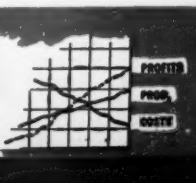

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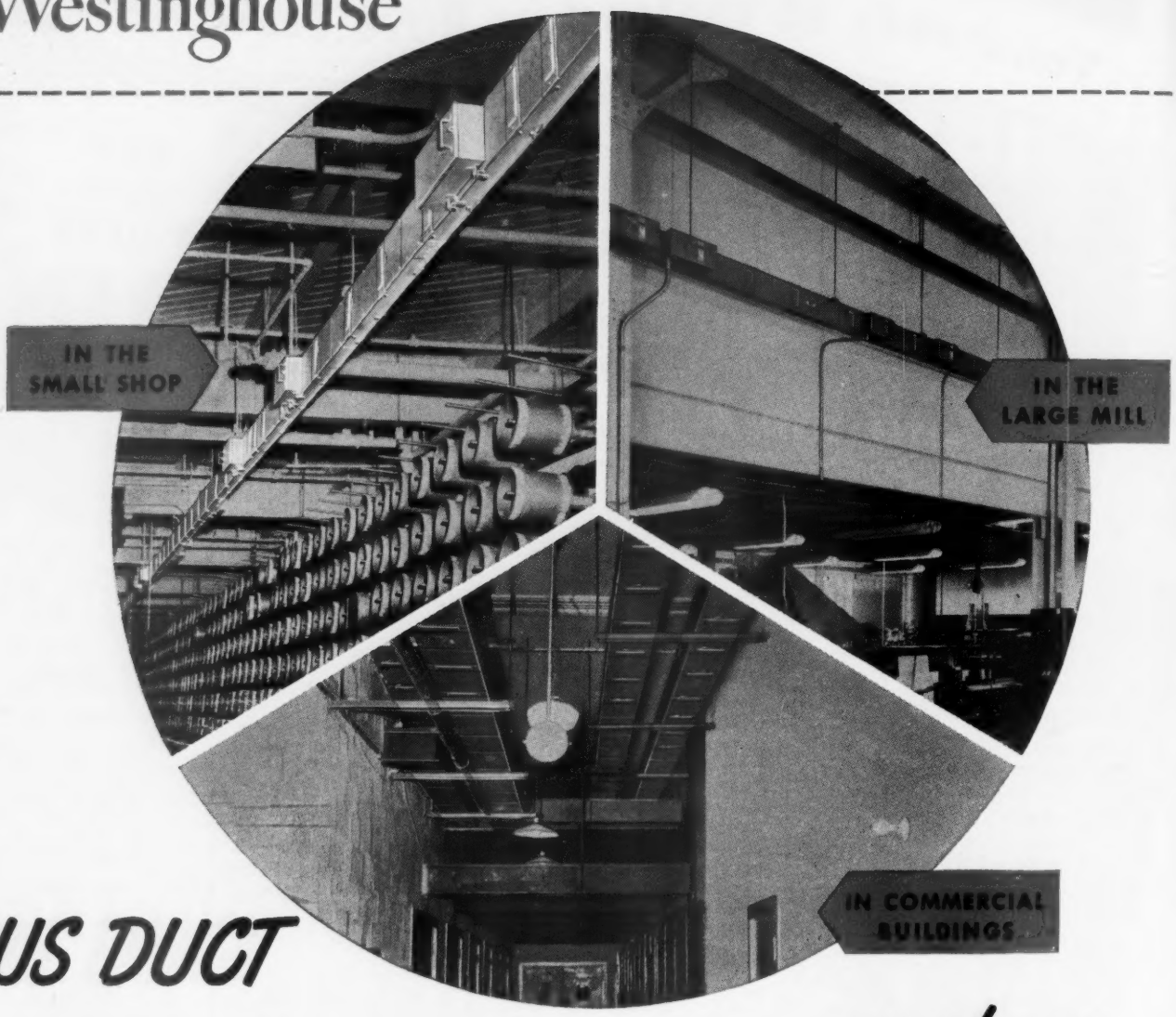
# Westinghouse




## BUS DUCT

## brings full secondary power *anywhere*

From the small machine shop, using only 20 or 30 feet of duct, to giant plants employing over 15,000 feet, bus duct makes a distinct improvement in secondary power distribution.

Automotive plants; metalworking shops; steel and textile mills; food processing plants; department stores; office buildings; these are only a few of the thousands of places enjoying bus duct's low-cost installation, reduced maintenance and availability of power where needed.

Operations can be expanded at any time without expensive rewiring and with minimum expenditure of time and labor.

Experienced Westinghouse field engineers are available to help plan your secondary power distribution system. For full particulars, phone your nearest Westinghouse office or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

J-30009

Westinghouse

BUS DUCT

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PUSH PRODUCTION • CUT COSTS • MAKE MONEY

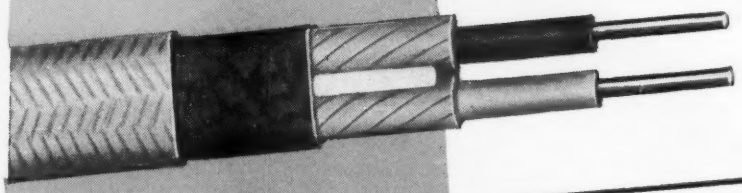
# "engineered extras"

## IN THESE HAZARD CABLES

**HELP YOU GET MORE BUSINESS**

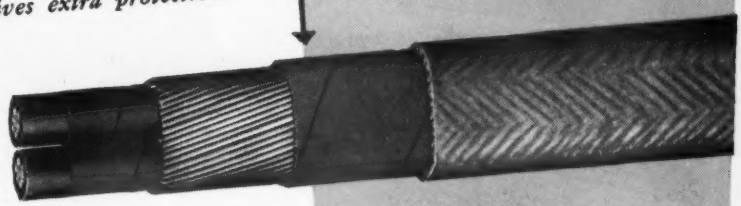
### HAZARDEX SNO-FLEX CABLE

Here's a non-metallic sheathed cable with the *extra advantage of a smooth white finish* that gives you a *distinctive* product to sell. It's the cleanest cable to handle, requires no conduit, strips neatly and quickly. The simple construction of Sno-flex makes it fast to splice and install. Sno-flex is the perfect answer to the problem of wiring houses after plastered walls are finished. It costs no more than regular Hazardex. Approved by the Underwriters' Laboratories, Inc. for both open work and concealed wiring.



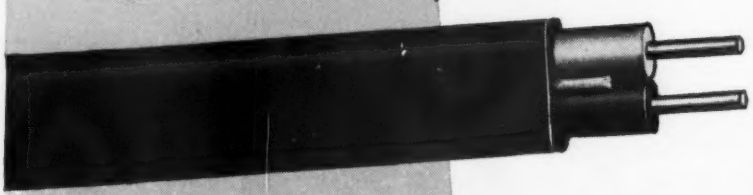
### HAZARD SERVICE ENTRANCE CABLE

With types UBN and ABN, black and red Okobestoprene Tapes are wrapped over the individual insulated conductors in place of the ordinarily used color coded braids. *Okobestoprene Tape, an Okonite developed asbestos-neoprene combination, gives extra protection against flame, moisture, mildew, acids and alkalis.* Another layer of this tape is wrapped over the bare neutral conductor as a moisture seal and to help assure an absolutely clean concentric conductor to work with. This long-lived cable construction is another "no-extra-cost" special from Hazard engineers that helps you get more business. Hazard Service Entrance Cables carry full approval of the Underwriters' Laboratories, Inc.



### HAZARDEX-WATERTITE ML

For farm wiring or other severe service locations, *the extra protection against moisture and acid engineered into this special non-metallic sheathed Hazard cable is without equal.* The individual conductors are protected with Watertite insulation. This Hazard developed, moisture-resistant insulation has proved its durability in severest service for many years, in both above-ground and direct-burial installations. Over each insulated conductor a thin neoprene covering is added for still more protection. The entire cable assembly is finally guarded against moisture, destructive fumes, oil, fire, heat, sun, weather and abrasion by a tough Hazaprene Sheath. Hazardex-Watertite ML is a compact, easy to handle, unusually quick to install cable.



**For more information about the above Hazard cables see your jobber, your Hazard representative or write to Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.**

**HAZARD** Insulated wires and cables for every electrical use

7723

**Use WESCO'S P-C Service for Profits**

**PUSH PRODUCTION • CUT COSTS • MAKE MONEY**

# LOUDEST BELL

LONGER LIFE!

DIE-CAST HOUSING!

EASY TO INSTALL!

FITS ALL MOUNTINGS!

NO MECHANICAL CLATTER!

EDWARDS COMPANY
U.S. PAT. NO. 2041991
AND PATENTS PENDING
DO NOT REMOVE GONG. LOOSEN LOCKING
SCREW AT BOTTOM. PULL BOTTOM OF BELL
AWAY FROM WALL, LIFT UP AND OFF HANGER
ADAPTABEL
TM REG.

*Patents Pending*

## LOUDEST BECAUSE:

1. **HARDER HITTING.** Tests prove new Adaptabel plunger strikes gong shell with greater force.
2. **QUICKER RETURN.** New Adaptabel plunger rebounds from shell faster.. far less interference with sound waves.
3. **MATCHED FREQUENCY.** The frequency of plunger strokes is timed perfectly to gong "breathing"—or sound waves.

# EDWARDS *New*

**Use WESCO'S P-C Service for Profits**

**PUSH PRODUCTION • CUT COSTS • MAKE MONEY**

# EVER MADE!

## Independent, certified tests* prove ADAPTABELS up to 420% LOUDER than any other bells...at any price!

• The NEW ADAPTABEL was a war baby, developed to meet service conditions far beyond normal needs.

A metal had to be found that would take the roughest possible punishment . . . and so the famed, incredibly tough "Z" metal was born! That's one reason why your Adaptabels now will give between 30 and 40 years of normal service! Compare that with any other bell!

A bell was needed that could be heard, loud and clear and penetrating, above the din of a battlewagon in action! Again Edwards' signaling experience—the oldest in this country—came up with the answer:

*Size for size, ADAPTABEL is up to 420% louder than any other bell made! Recognized testing authorities* proved that the 4" ADAPTABEL is actually louder than all other 10" bells!*

Whatever your needs, you can be sure of this: Adaptabel is the "most" bell by any standard... loudness, clarity, long-life, economy! Write today for new Adaptabel bulletin.

**EDWARDS COMPANY, INC., NORWALK, CONN.**
*In Canada: Edwards of Canada, Ltd.*

*Results of an independent laboratory test prove the amazing superiority of Edwards 6" ADAPTABEL over the four other best known brands of bells:

**EDWARDS 6" ADAPTABEL IS:**

**58% LOUDER than 6" bell brand A**
**107% LOUDER than 6" bell brand B**
**142% LOUDER than 6" bell brand C**
**420% LOUDER than 6" bell brand D**

### Need 10" volume? Get it with Edwards 6" economy!

Do your signaling requirements call for a 10" bell? The same tests reported above proved that the 6" ADAPTABEL is from 66% to 115% LOUDER than the four leading brands of 10" bells tested!

# ADAPTABEL

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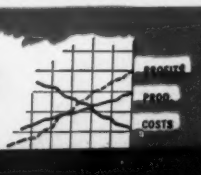
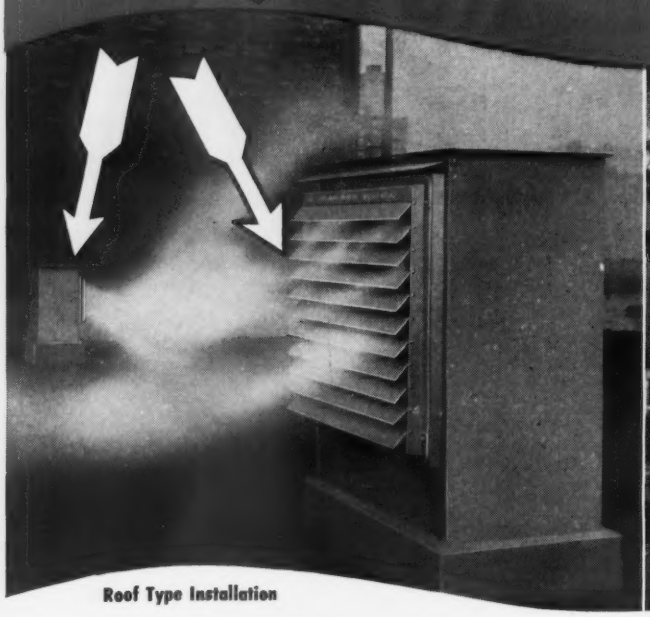
PUSH PRODUCTION • CUT COSTS • MAKE MONEY


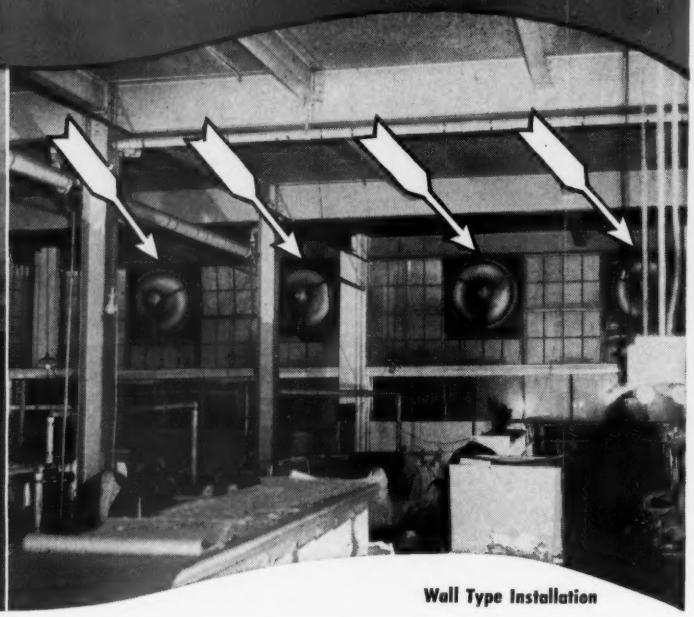
# Increase productivity . . . reduce accidents . . . cut costs with

# ILG VENTILATION

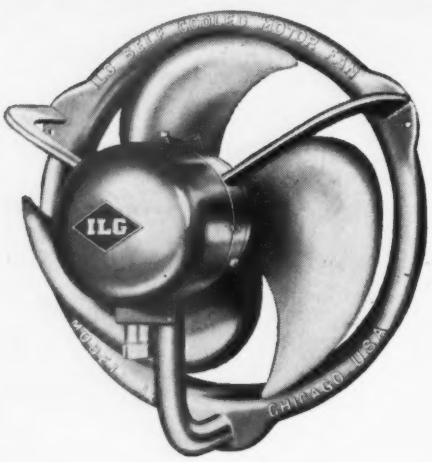
REG. U. S. PAT. OFF.



Roof Type Installation



Wall Type Installation




**NEW TYPE "Q" SELF-COOLED MOTOR PROPELLER FAN**

***Extra* QUIET *Extra* POWERFUL!**

## Cooler Weather Emphasizes Need for Adequate Ventilation

NOW—when doors and windows are closed —there's a decided need for good ventilation. Fresh, clean air keeps workers alert . . . improves working conditions . . . increases production. Quiet, powerful ILG Self-Cooled Motor Propeller Fans drive out profit-sapping foul air . . . pull in clean, invigorating air. Phone nearby Branch Office (consult classified directory) or write for Booklet No. 148-1.

ILG ELECTRIC VENTILATING CO.
2879 N. CRAWFORD AVE. • CHICAGO 41, ILLINOIS

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**PUSH PRODUCTION • CUT COSTS • MAKE MONEY**

# EXPOSED WIRING UNDER COVER

WITH

# NATIONAL ELECTRIC WIREWA

This accurately made hinged coupling speeds installation . . . adds rigidity to sections for lifting into place, and serves as a hanger. Simply place around sections to be joined, tighten two bolts, and the job is done!

For safety's sake, put long runs of exposed wiring under a steel cover . . . quickly . . . easily . . . with National Electric 4 x 4 WIREWA. This ready-made raceway provides practically the same convenience and accessibility of an exposed wiring system—PLUS . . .

- ***Safe,* permanent protection.**
- **Accessibility . . . Wiring changes made easily.**
- **Plenty of room . . . 16 sq. inches of WIREWA for wire fills and tap-offs.**
- **Multiple KO's for conduit take-offs on two sides.**
- **Ease of installation . . . Sections securely joined by hinged couplings . . . Fittings for every requirement.**
- **Low maintenance . . . Simple to re-route and extend . . . 100% salvable.**
- **Listed by Underwriters' Laboratories, Inc.**

The booklet "A Wirewa You'll Like" illustrates all fittings and contains installation data. We'll gladly send you a copy.

NATIONAL ELECTRIC PRODUCTS WIRING & SYSTEMS WIRES AND CABLES

**National Electric**
**PRODUCTS CORPORATION**
1301 CHAMBER OF COMMERCE BLDG., PITTSBURGH 19, PA.

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PROFITS
PROD.
COSTS

NO. 950
FLASHLIGHT BATTERY

# Tops!

## for long-life, general purpose service!

NO. 1050
FLASHLIGHT BATTERY

# Tops!

## for repeated heavy-duty use!

*The term "Eveready" is a registered trade-mark of*
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RAILROAD DEPARTMENT
30 East 42nd Street, New York 17, N. Y.
*Unit of Union Carbide* UCC *and Carbon Corporation*

Division Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

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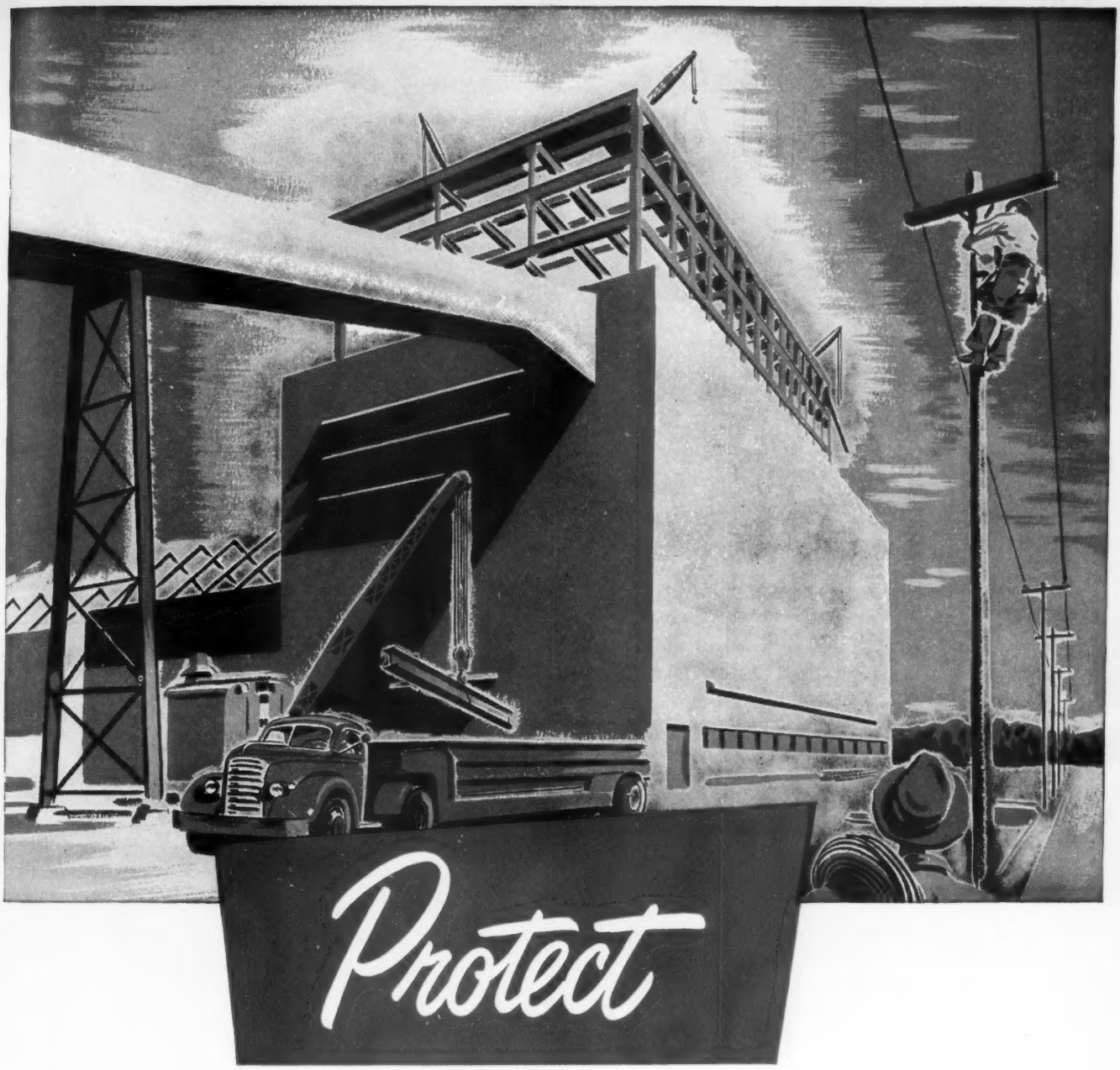


# your new Industrial Customers by using OLIVER POLE LINE MATERIALS

The new industrial plants that soon will be depending upon you for electricity, rightfully expect your line construction to be *dependable*—just as your older customers do.

When you specify *OLIVER* Pole Line Materials, you make sure that you are getting the very best that long experience and modern manufacturing methods can produce.

OLIVER
IRON AND STEEL
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South Tenth and Muriel Streets • Pittsburgh 3, Pa.

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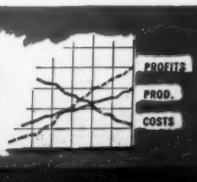
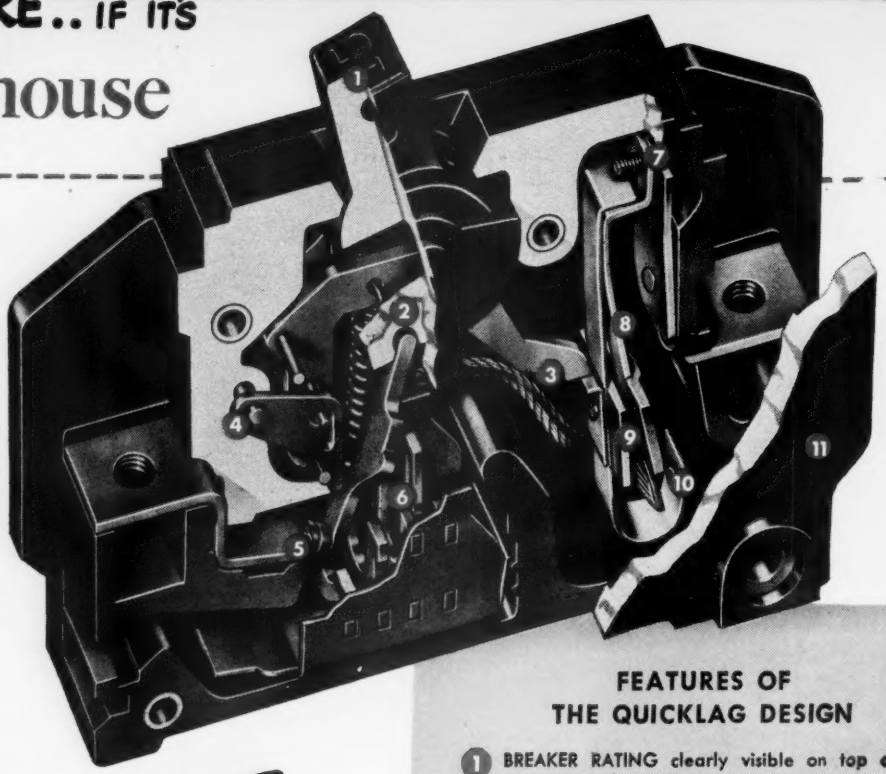


YOU CAN BE SURE.. IF IT'S

# Westinghouse




## FEATURES OF THE QUICKLAG DESIGN

1. BREAKER RATING clearly visible on top of handle.
2. QUICK-MAKE and BREAK mechanism.
3. HEAVY-DUTY FLEXIBLE SHUNT is electrically welded for a strong mechanical connection and for minimum wattage loss.
4. DISSIMILAR METAL BEARING SURFACES insure against sticking and reduce wear.
5. SILVER COMPOSITION CONTACTS have low resistance, guarantee long life.
6. "De-ion" ARC EXTINGUISHER minimizes arcing, increases contact life.
7. ACCURATE CALIBRATION calibrating screw provides accurate calibration . . . is sealed against tampering.
8. BI-METAL THERMAL ELEMENT trips breaker on sustained overloads.
9. ELECTROMAGNETIC ELEMENT provides instantaneous tripping on short circuits.
10. ELECTRICALLY WELDED . . . all connections.
11. ENTIRELY ENCLOSED in a case of hot-molded insulating material.

CORROSION-PROTECTED all parts are specially selected or treated to resist corrosion.

# INFALLIBLE

## CIRCUIT PROTECTION

A Westinghouse Quicklag Circuit Breaker provides not just one means of circuit protection, but *two types!* An *electromagnetic element* that trips instantly on short circuits . . . a *bimetallic thermal element* that allows time delay on harmless momentary current surges.

Both types are needed for completely automatic, dependable circuit protection at all temperatures. The National Electric Code recognizes and approves the automatic derating feature of bimetallic elements at elevated temperatures. High surrounding temperature will not change the protective efficiency of a Quicklag, because the bimetallic element derates in the same degree as the wire or cable it protects.

Call your nearest Westinghouse office for complete information on modern, dependable circuit protection or write for bulletin B-3881. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-30008

**Westinghouse**
**QUICKLAG**
**CIRCUIT BREAKERS**

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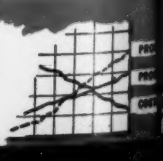


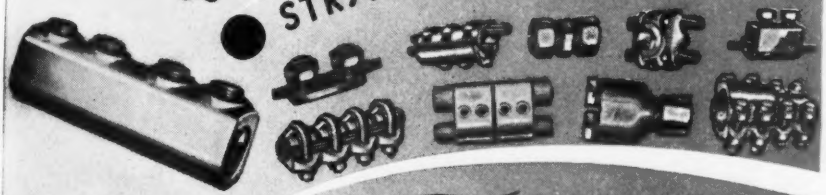
*You can find the*

# EXACT FITTING

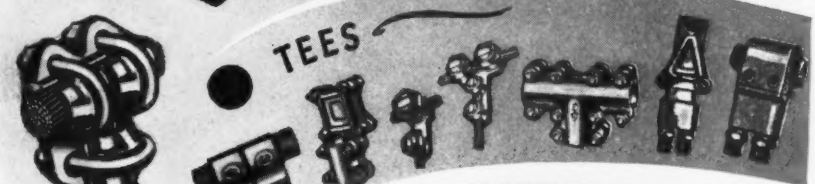
**you need — in the**

SERVICE CONNECTORS

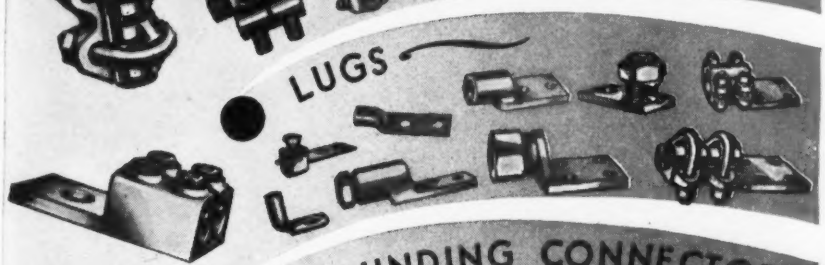
STRAIGHT CONNECTORS



TEES



LUGS

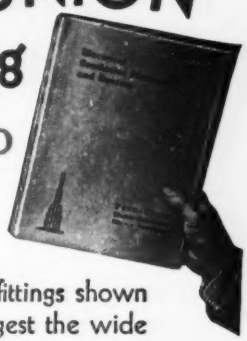


GROUNDING CONNECTORS

and MANY MORE

## PENN-UNION Catalog

at any WESCO Branch



The conductor fittings shown here can only suggest the wide variety. You'll find practically every good type, in a complete range of sizes.

New connectors are constantly being added - - so when you need a special fitting for an unusual service, tell us about it. Most likely we have exactly what you want.

**Better design** is a Penn-Union feature that you'll appreciate. For example, note the large gripping surfaces for wrenches, on the service connector shown in the upper left corner. When you use any Penn-Union fitting, you are sure that it is dependable - - mechanically and electrically.

*The most important items are Listed by Underwriters Laboratories*

**Preferred by Leading Users,** who have found that the "Penn-Union" mark on a connector is their best guarantee of unfailing service.

*Stocked by Wesco Branches*

*Sold by Leading Wholesalers*

**PENN-UNION ELECTRIC CORP.**

**ERIE, PA.**

**Canada: Dominion Cutout Company, Ltd., 250 Richmond St. West, Toronto**

*The COMPLETE Line of Conductor Fittings*

**PENN-UNION**

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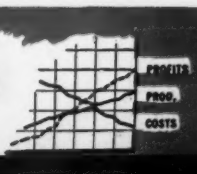
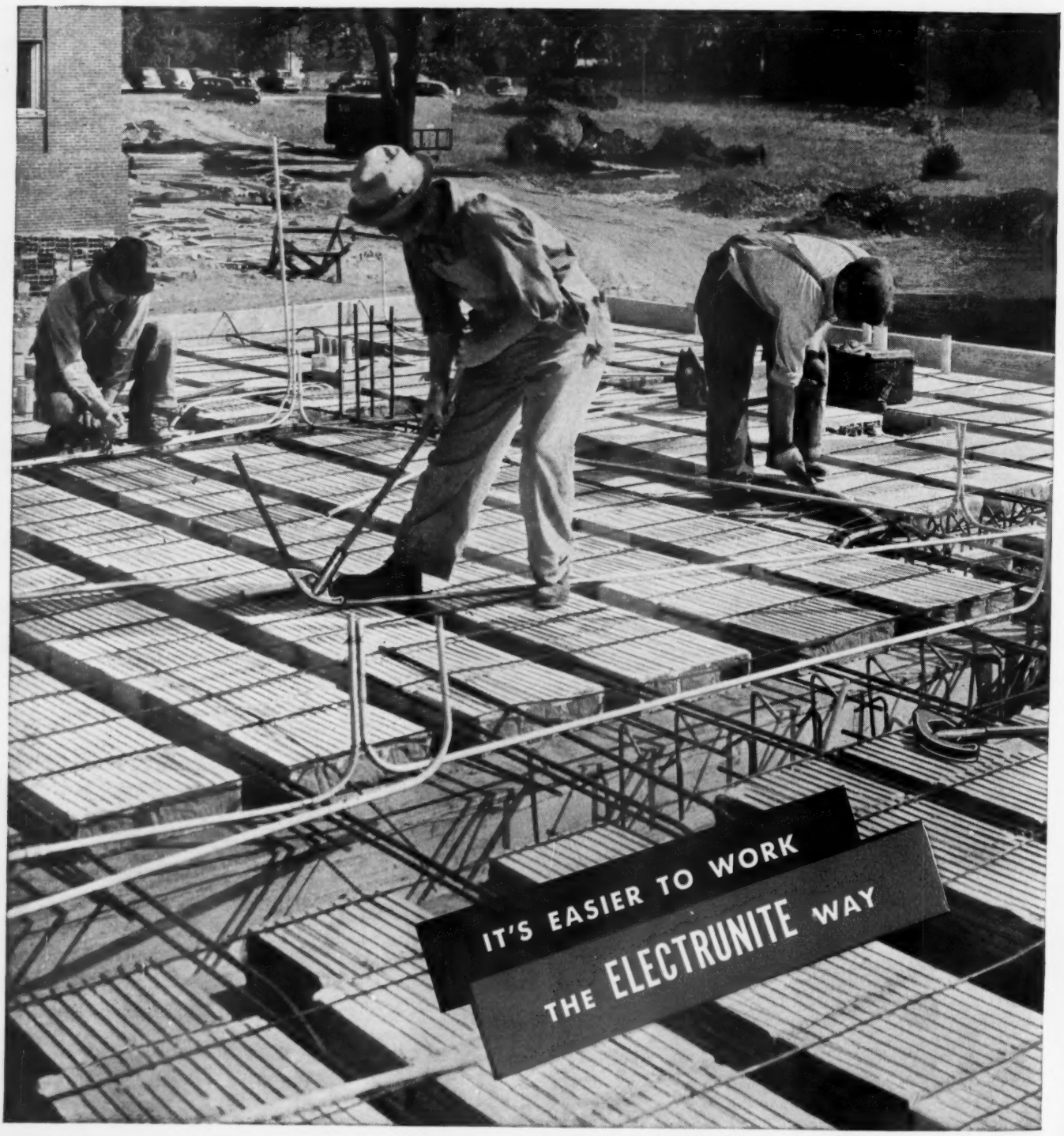


# ELECTRUNITE

## HELPS PUSH PRODUCTION

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# —THE *Original* E.M.T.

# . . . CUTS RACEWAY COSTS

• Here's real help for the contractor who appreciates the cost-saving advantages of completing raceway installations on schedule. With Republic ELECTRUNITE E.M.T. —the *modern* lightweight rigid steel wiring raceway—all types of installations go in easier and faster, at resulting lower cost.

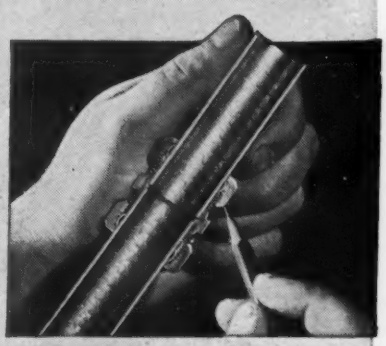
Four of the time-saving installation features, including those offered *only* by ELECTRUNITE E.M.T., are shown at the right. But that's only part of the story. Equally important are the safety and dependability of ELECTRUNITE E.M.T. raceways.

ELECTRUNITE E.M.T. is approved by the National Electrical Code for installation in exposed, concealed and concrete slab construction. Underwriters' Laboratories inspection provides full assurance that this up-to-date conduit meets standard requirements for electrical and mechanical protection.

For complete information about Republic ELECTRUNITE E.M.T., see your nearest ELECTRUNITE DISTRIBUTOR, or write us *today* for informative literature.

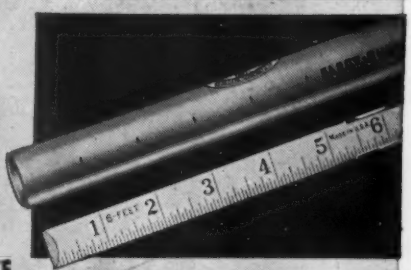
**REPUBLIC STEEL CORPORATION**
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

## ONLY ELECTRUNITE E.M.T. AFFORDS ALL 4 JOB-PROVED ADVANTAGES



**NO THREAD-CUTTING**
Simple, compression fittings eliminate tedious, dirty thread-cutting . . . both couplings and box connectors are easily tightened with wrench or pliers to form strong, water-tight joints.

**EASY TO BEND**
With ELECTRUNITE E.M.T. and the patented, one-piece ELECTRUNITE Bender, anyone can make all types of bends, stubs and offsets with predetermined accuracy.



**INCH MARKING**
Exclusive ELECTRUNITE E.M.T. feature, consisting of clear, easy-to-read inch and foot marks on every length of ELECTRUNITE E.M.T. in most popular sizes.

**KNURLED INSIDE SURFACE**
Another ELECTRUNITE exclusive feature which, by actual test, makes wire-pulling as much as 30% easier than with ordinary raceways.

REPUBLIC STEEL

*Republic*
ELECTRUNITE E.M.T.

LIGHTWEIGHT THREADLESS RIGID STEEL RACEWAY

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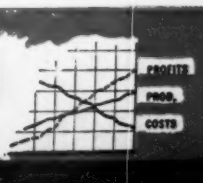
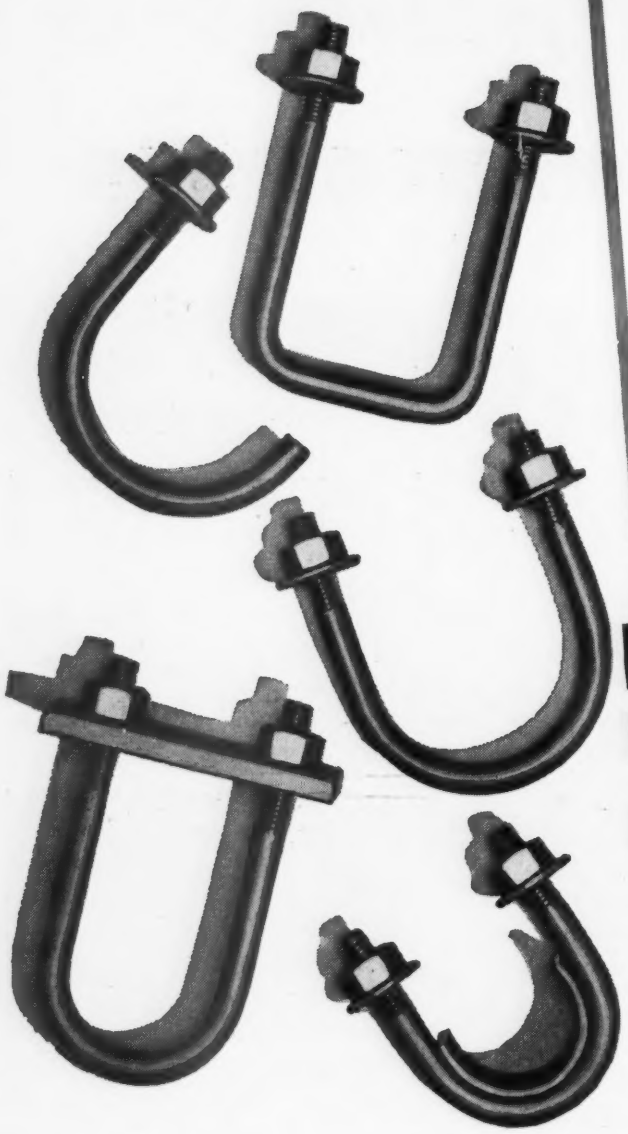


# OVER 78 WAYS TO MAKE SURE CONDUITS STAY PUT!



## O.Z. has 'em ...IN STOCK

**When you need U-BOLTS for that conduit or cable clamping job, try O-Z.**

**WHY?**

**BECAUSE** the O-Z line is *in stock*, ready for immediate shipment.

**BECAUSE** the stock O-Z line has over 78 sizes and types for conduits from ½" to 6". As just one example, you can get *three* bolt diameters, for 1", 1¼" or 1½" conduit. You can get O-Z U-BOLTS, from stock of Everdur, steel cadmium plated or steel hot-dip galvanized. They come with nuts and flat washers, with or without saddles. They provide for clamping to a ⅜" thick plate using nuts and washers on each leg.

**BECAUSE** O. Z. will manufacture U-BOLTS of any size or material to meet your specifications.

There are thousands of O-Z products designed to help you put power where you want it, and your O-Z Distributor is the man to see about them. Send for illustrated catalog.

## and Remember! THEY'RE O.K. IF THEY'RE O.Z.

**O.Z. ELECTRICAL MANUFACTURING COMPANY, INC.**

262 BOND STREET · BROOKLYN 2, N. Y.

CONDUIT FITTINGS
CABLE TERMINATORS
CAST IRON BOXES
GROUNDING DEVICES
SOLDERLESS CONNECTORS
POWER CONNECTORS

5060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# Choose the Time Switch you need from this *Complete* Line

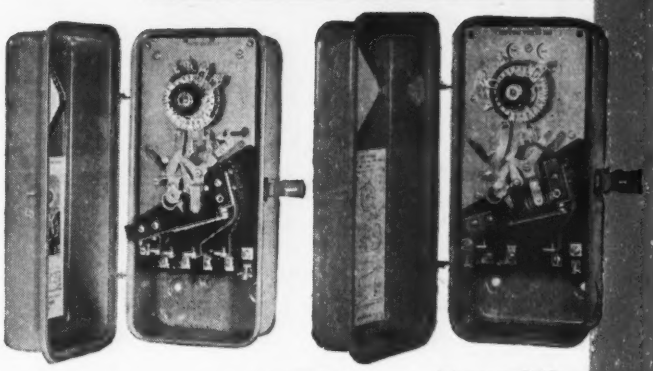
## *Specify* **SANGAMO** *for Assured Performance*

### "Precision in Miniature"

**Type S Time Switch**
Single Pole
Single Throw

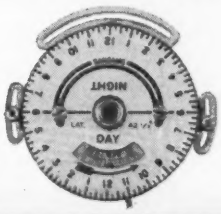
**Type TJ**
Plug-in Type
Interval Timer

### Heavy-Duty Switches



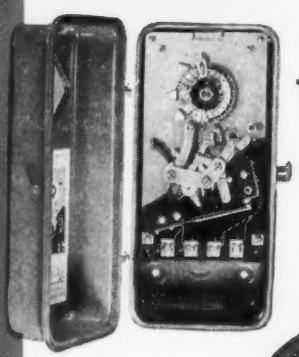
**Type L**
Synchronous

**Type W**
Synchronous-carryover

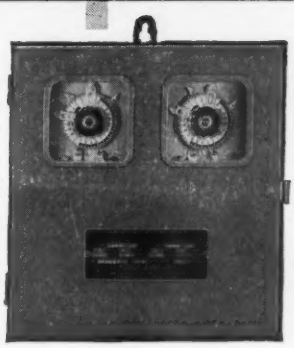



**Astronomic Dial**

### Special Duty Time Switches

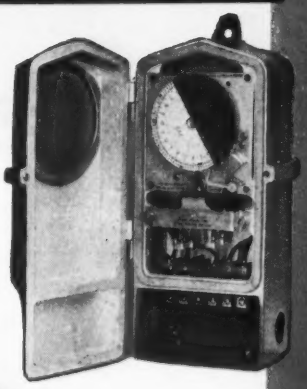


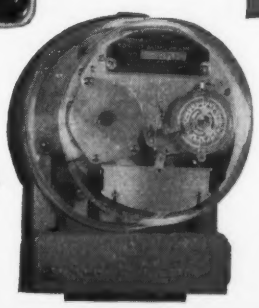
**Type LY**
Two-Circuit



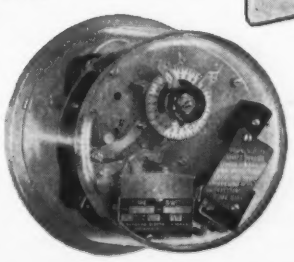
**Type LD**
Duplex

**Type TC**
Electrically-wound





**Type MA**
Synchronous



**Type WS**
Synchronous-carryover

50TH ANNIVERSARY SANGAMO 1899 - 1949

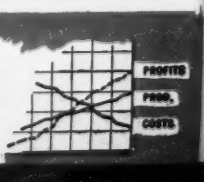
ST4929

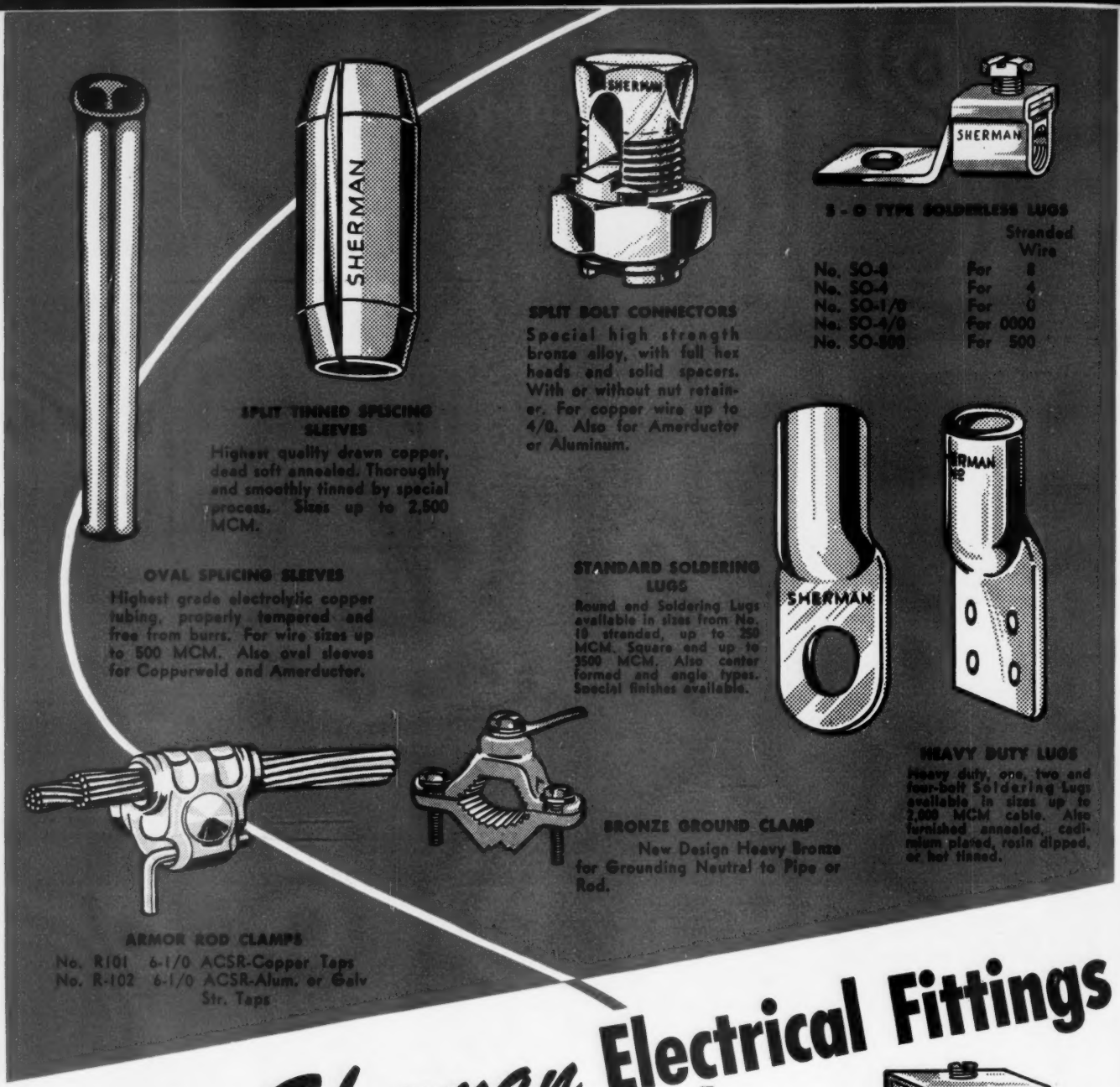
# SANGAMO ELECTRIC COMPANY

SPRINGFIELD · ILLINOIS

**Use WESCO'S P-C Service for Profits**

**PUSH PRODUCTION • CUT COSTS • MAKE MONEY**






**SPLIT TINNED SPLICING SLEEVES**

Highest quality drawn copper, dead soft annealed. Thoroughly and smoothly tinned by special process. Sizes up to 2,500 MCM.

**OVAL SPLICING SLEEVES**

Highest grade electrolytic copper tubing, properly tempered and free from burrs. For wire sizes up to 500 MCM. Also oval sleeves for Copperweld and Amerductor.

**SPLIT BOLT CONNECTORS**

Special high strength bronze alloy, with full hex heads and solid spacers. With or without nut retainer. For copper wire up to 4/0. Also for Amerductor or Aluminum.

**S - O TYPE SOLDERLESS LUGS**

| | Stranded Wire |
|---|---|
| No. SO-8 | For 8 |
| No. SO-4 | For 4 |
| No. SO-1/0 | For 0 |
| No. SO-4/0 | For 0000 |
| No. SO-500 | For 500 |

**STANDARD SOLDERING LUGS**

Round end Soldering Lugs available in sizes from No. 10 stranded, up to 250 MCM. Square end up to 3500 MCM. Also center formed and angle types. Special finishes available.

**HEAVY DUTY LUGS**

Heavy duty, one, two and four-bolt Soldering Lugs available in sizes up to 2,000 MCM cable. Also furnished annealed, cadmium plated, rosin dipped, or hot tinned.

**BRONZE GROUND CLAMP**

New Design Heavy Bronze for Grounding Neutral to Pipe or Rod.

**ARMOR ROD CLAMPS**

No. R101 6-1/0 ACSR-Copper Taps
No. R-102 6-1/0 ACSR-Alum. or Galv Str. Taps

# Specify *Sherman* Electrical Fittings

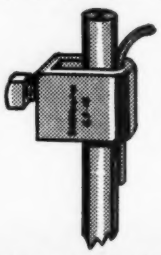
Electrical Fittings are bought for just one purpose — to do a job — and the best recommendation for any fitting is proof of its ability to do that job.

Sherman Fittings have demonstrated their sturdiness and dependability on countless installations. You don't have to guess or hope that they'll work. For years they have been proving their strength, uniformity, and reliability under the toughest service conditions.

Why not simplify your maintenance problems when you make installations, by specifying Sherman Connectors — the connectors they all say are O. K.

**"WEDGE GRIP" CONNECTORS**

Six types available for wire sizes from No. 18 to No. 2 stranded wire.



**"BOND ROD" GROUND CLAMPS**

No. GF-16 3/8" or 1/2" Rod
No. GF-17 1/2" or 5/8" Rod

## H. B. SHERMAN Mfg. Co. Battle Creek, Mich.

# Use WESCO'S P-C Service for Profits

**PUSH PRODUCTION • CUT COSTS • MAKE MONEY**

KNOWN, USED AND SPECIFIED THE WORLD OVER!

# SWIVELIER

Look for the "SWIVELIER" Trade-Mark on every "SWIVELIER" fixture.

## *Universally Adjustable* LIGHTING FIXTURES

**DESIGNED AND ENGINEERED TO GIVE MAXIMUM RESULTS — "STAYS PUT . . . AT ANY ANGLE!"**

Patented

### SPRING TENSION SWIVELIER SOCKET

*Has these FEATURES and ADVANTAGES . . .*

- Universally Adjustable 90° Vertical 350° Horizontal
- "STOP" prevents wires twisting
- No Wing Nuts or Set Screws
- "STAYS PUT . . . AT ANY ANGLE!"
- Will Not Work Loose

Used in All Adjustable "Swivelier" Units

Adjusts from "FLUSH" Position to 90° Vertical Range—360° Horizontal Range

### UNIVERSALLY ADJUSTABLE "GYRO-LITE"

No. 725

SENSATIONALLY NEW RECESSED LIGHTING UNIT FOLLOWS THE DISPLAY ALL AROUND!

90° Vertical Adjustment
360° Horizontal Adjustment

"GYRO-LITE" ADJUSTS TO ANY POSITION!

FLUSH | 15° | 30° | 45° | 60° | 75° | 90°!

plus 360° Horizontal Adjustment

For Vertical Adjustment, Pull Shade Out to Desired Angle! | Ring Rotates Within Housing

"SWIVELIER" Universally Adjustable

### "TORPEDO" Shade Units

Specified by modern architects and lighting engineers.

No. 881

No. 880-12

### SWIVELIER Universally Adjustable "CHANNELITES"

No. F730 · No. 730 · No. B730 · No. 3000 Wiremold Raceway · No. H730

for use on "WIREMOLD" Raceways No. 2100 and 3000 (illustrated). Completely assembled, wired, ready to attach.

### SWIVELIER "MIDGET-LITES"

No. MBT · No. 780 · No. M627

designed for use with 75-Watt R30 Lamps

Also available . . . Clamp-On Type and Extension Stem Type

### SWIVELIER "STANDARD TOP-LITE"

No. 811

Recessed ceiling fixture with louver
Accommodates Color Lens

### SWIVELIER UNIVERSALLY ADJUSTABLE WIRING DEVICES

No. 817 · No. 57 · No. 107-S · No. 2547 · No. 607AH · No. 517 · No. 107

Over 300 types of "SWIVELIER" Lighting Fixtures provide the correct answer for every lighting problem.

Order complete Swivelier catalog from your nearest Wesco office, or

SWIVELIER COMPANY, Inc. 30 Irving Place, New York 3, N. Y.

# Use WESCO'S P-C Service for Profits

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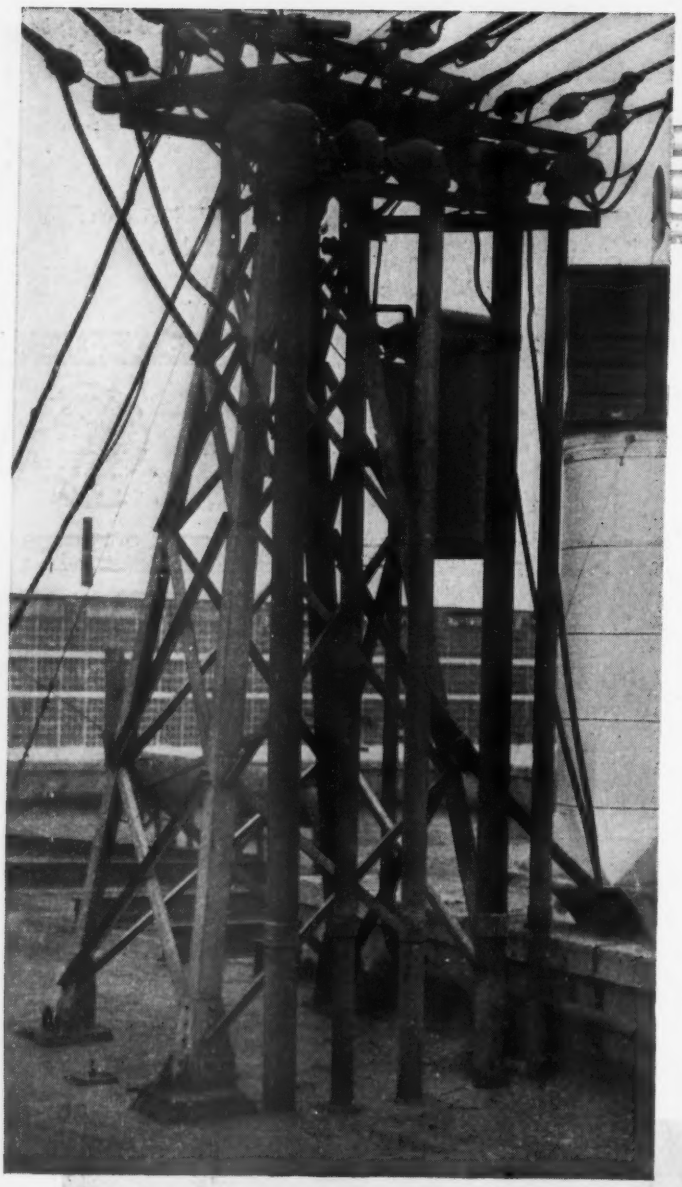
*You're sure of..*

# FAST MAKE-UP ...with

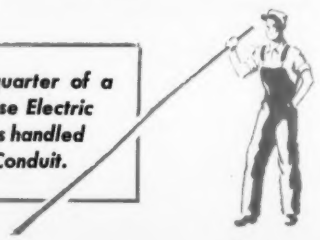
# CENTRAL SPANG CONDUIT

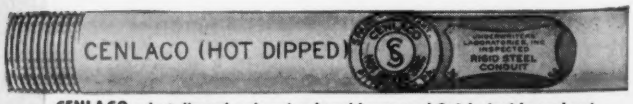


• Many contractors say that the threads on Central Conduit and Couplings help them save time. These threads are cut on automatic machines—then checked by careful inspectors to be sure the lead, taper and depth are correct. The results are smooth running threads that assure fast make-up and safe, tight joints.

Central Rigid Steel Conduit meets all the requirements of the National Electrical Code —and every length bears the seal of the Underwriters' Laboratories, Inc.

*For more than a quarter of a century Westinghouse Electric Supply Company has handled Central Rigid Steel Conduit.*






**CENLACO** a hot dipped galvanized and lacquered finish, inside and out.

**CENTRAL WHITE** electro-galvanized outside and black enameled inside.

**CENTRAL BLACK** permanent, baked-on black enamel finish, inside and out.

**SPANG-CHALFANT**
Division of The National Supply Company
General Sales Office: Grant Building, Pittsburgh, Pa.
District Offices and Sales Representatives in Principal Cities

## Use WESCO'S P-C Service for Profits

**PUSH PRODUCTION • CUT COSTS • MAKE MONEY**

# Westinghouse

## *Fluorescent Lamps*

# NOW LAST 3 TIMES AS LONG!

**...YET COST NO MORE!**

## SAVE 2/3

**SAVE THIS –** LAMP COSTS

ONE LAMP NOW LASTS AS LONG AS 3.

**SAVE THIS –** TIME SPENT REPLACING BURNED-OUT LAMPS

LAMPS NEED BE REPLACED ONLY ⅓ AS OFTEN.

Here's the biggest news in fluorescent lamps that's come along in years . . . NOW Westinghouse fluorescent lamps will last 2½ years in average store installations . . . 3 years in average one-shift office or factory installations.

Light output, too, has been improved—Westinghouse fluorescent lamps now burn brighter and longer than ever before. So, when you buy lamps, buy Westinghouse and save! Lamp Division, Westinghouse Electric Corp., Bloomfield, N. J.

## YOU CAN BE SURE... IF IT'S Westinghouse

## Use WESCO'S P-C Service for Profits

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# LIGHT! When You Need It-Where You Need It-with

# Big Beam PORTABLE ELECTRIC HAND LAMPS

## MODEL 211 BIG BEAM

The popular price, quality-built portable electric hand lamp. A simple focus adjustment gives a choice of a powerful, 1500-foot beam or spread lighting. A double-throw, finger-tip control switch lights either the main or the auxiliary bulb. The head is adjustable for directing the light. Powered by dry-cell lantern batteries, it is light in weight and convenient to carry. "D" rings on the handle make it easy to use with shoulder carrying strap.

## MODEL 802 BIG BEAM

This is a dry-cell model emergency auxiliary lighting unit. Its extension cord plugs into any lighting outlet. When, for any reason, the circuit fails, the lamp automatically goes on providing instant lighting. The heads have wide adjustment for directing the powerful light where needed. This model meets a must where building laws require auxiliary emergency lighting in theatres, hospitals, department stores, etc. It operates on four standard No. 6 dry-cell batteries.

## MODEL 700-A BIG BEAM

This is the most powerful hand lamp of its size. A double-throw switch gives a choice of a powerful, 2000-foot beam or the dim light that extends the life of the batteries. It operates on four No. 6 dry cells. Vertical adjustment of the head permits directing the light at any angle.

## MODEL 400-F BIG BEAM ELECTRIC FLARE

This is a weatherproof, combination emergency light and signal flare that operates in any position. A single-pole, double-throw toggle switch, when thrown to one side, operates the lamp as a flashing flare; when thrown to the opposite side, it operates as a steady flare or lantern. Two bulbs light independently of each other. In the event that one burns out, the other remains lighted. A third bulb, in a dummy socket a little below the others, is readily available in case of a burnout. The bulbs are covered with a red Fresnel lens of molded plastic. Clear, blue, or green Fresnel lenses are available. A rubber gasket provides sealed protection for the entire socket unit.

## MODEL 312 BIG BEAM

This is a rechargeable portable electric hand lamp with a spillproof storage battery. A built-in, three-ball, visible specific gravity indicator shows when the battery is in need of charging. Within the container is the battery charger that plugs into any 110-volt, AC circuit. The cord for connecting the charger is carried within the container so that charging the battery is a convenient matter at any time.

A finger-tip control, double-throw switch selects either the large main bulb for a powerful, 2000-foot beam or the small auxiliary bulb for a dim light.

"D" rings are provided on the handle for a shoulder carrying strap.

Model 311 is the same as model 312 except with a larger battery and no charger.

*Various accessories, including hold-down bracket, swivel fitting, colored and floodlight lenses, and shoulder carrying strap are available as extras for all models of Big Beam portable electric hand lamps.*

**Write for Catalog on complete line of Big Beam Portable Electric Hand Lamps and Accessories**

**U-C LITE MANUFACTURING CO.** 1050 West Hubbard Street, Chicago 22, Illinois

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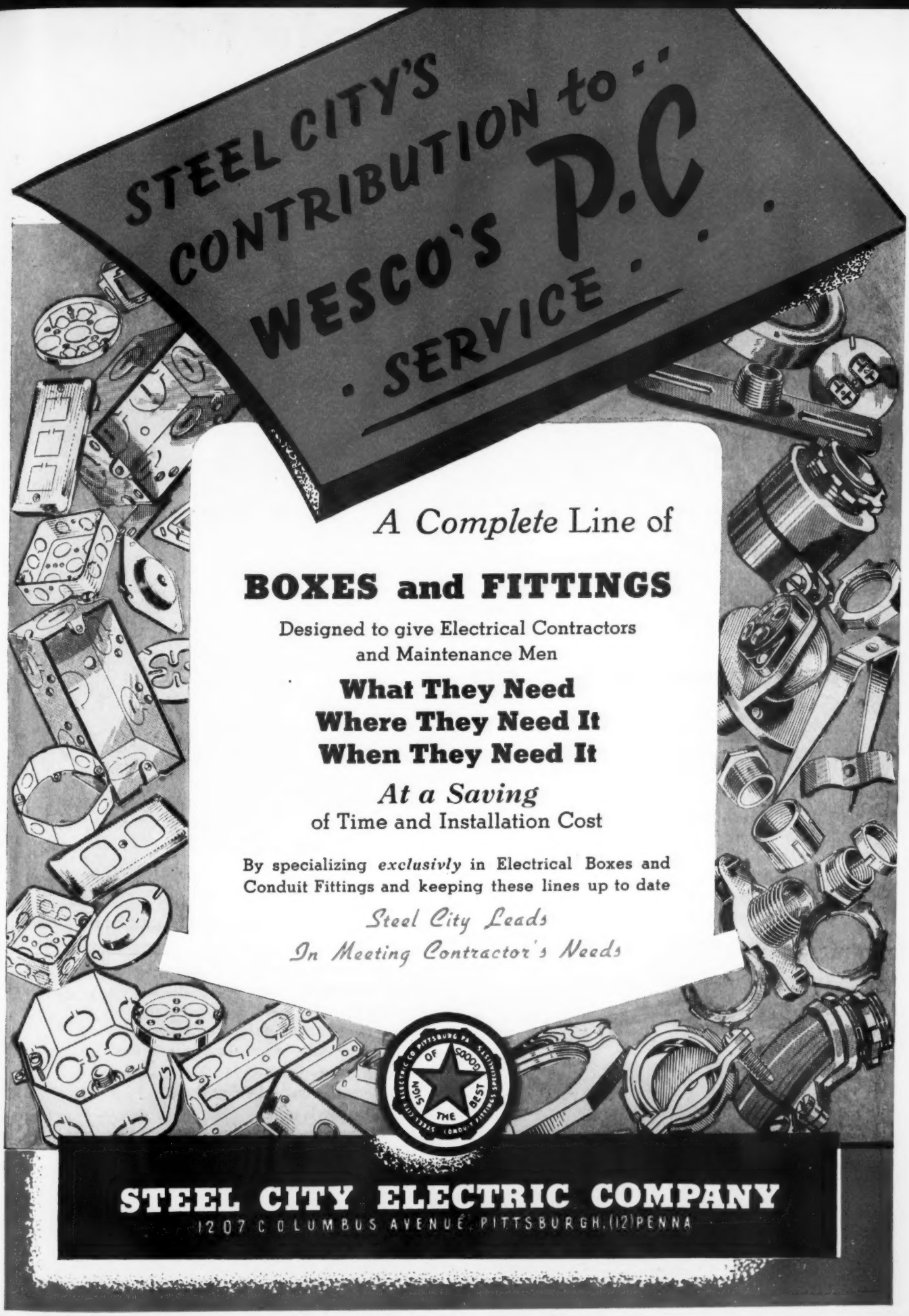
STEEL CITY'S
CONTRIBUTION to . . .
WESCO'S P.C
. SERVICE . . .
A Complete Line of
BOXES and FITTINGS
Designed to give Electrical Contractors
and Maintenance Men
What They Need
Where They Need It
When They Need It
At a Saving
of Time and Installation Cost
By specializing exclusivly in Electrical Boxes and
Conduit Fittings and keeping these lines up to date
Steel City Leads
In Meeting Contractor's Needs
SIGN OF THE GOOD BEST
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PROFITS
PROD.
COSTS

YOU CAN BE **SURE**.. IF IT'S

# Westinghouse

ATTRACTIVE STURDY

## ONE PIECE REFLECTORS

### Added reason to buy Westinghouse INDUSTRIAL FIXTURES

New Armorline Reflectors are *strong*—yet lightweight, compact and attractive. Drawn or formed from one piece of heavy-gauge steel, as shown by the above photo, Armorline Reflectors have no weld unions to weaken their strength. Pressure-molded contours are smooth—add attractive appearance to the unit—stop the collection of dust and dirt. This means less frequent cleaning.

Lamps, spaced only 3½" or 5" apart in Armorline fixtures permit one-piece Armorline Reflectors to be lighter in weight—less bulky—and easier to handle.

New Armorline Industrial Fluorescent Luminaires will meet many industrial lighting requirements. A Westinghouse Sales Engineer will gladly co-operate with you, your power company, your architect and electrical contractor in planning their use. Send for free copy of "Armorline Fluorescent Luminaires," Booklet B-4194. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-04236

**Westinghouse**

**PLANNED LIGHTING PAYS**

WESTINGHOUSE


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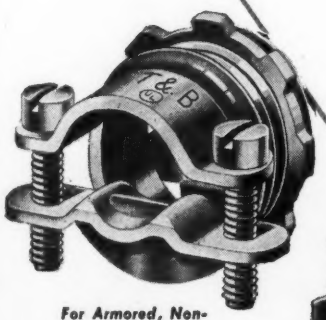
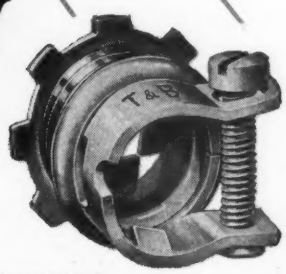
# all NEW T & B CONNECTORS

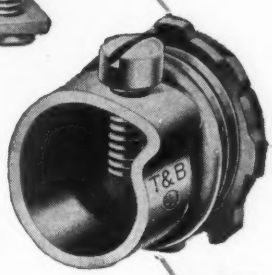
all UL Approved



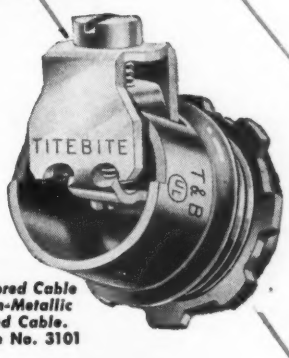
*For Armored, Non-Metallic or Service Entrance Cable and Flexible Conduit.*
Catalogue No. 3301



*For Armored Cable and Flexible Conduit.*
Catalogue No. 253



*For Flexible Conduit and Armored Cable.*
Catalogue No. 240




*For Armored Cable and Non-Metallic Sheathed Cable.*
Catalogue No. 3101

*For Armored Cable and Flexible Conduit.*
Catalogue No. 300

## DESIGN

Entire T&B line has been completely redesigned since war to accommodate entire expanded range of old and new cables, and meet requirements peculiar to every type of cable.

## MATERIAL

Entire line is now made of heavy-gauge steel for exceptional strength, uniform quality, full salvage value. No burrs, gate-marks, flaws, blowholes or embrittlement in these fittings.

## PERFORMANCE

Each connector designed to meet the specific requirements of specific installation problems. Precision engineered to make up tight, grip securely and to prevent cable injury.

## PRODUCTION

Entire line produced on brand new batteries of most modern, high-speed automatic machinery insuring accuracy of manufacture, extraordinary production capacity. We have them now!

Here they are . . . the *only* completely redesigned, modernized post-war line of connectors on the market! Every one of them is designed to do a specific job more efficiently, more economically. Every one is made of uniform quality, heavy-gauge steel. Every one of them is produced on T&B's superlative new high-speed, automatic machinery. If you need connectors . . . T&B has them; if you want top quality . . . the T&B trade mark is your guarantee that you have the best in the field today.

T&B ENGINEERED

Send for Samples

**THE THOMAS & BETTS CO.**
**INCORPORATED**
**ELIZABETH 1, NEW JERSEY**

**T & B PRODUCTS SOLD ONLY THROUGH THE T & B ELECTRICAL WHOLESALER**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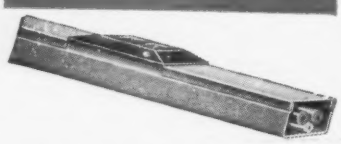
PROFITS
PROD.
COSTS

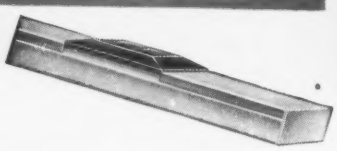
# You can PLUGMOLD this room by 3 methods

**unwired PLUGMOLD**



Provides complete flexibility. Wiring is done on the job . . . outlets may be placed where needed . . . easily added or relocated. *Approved with devices* in place for three No. 12 or No. 14 conductors.

**wired PLUGMOLD**



Factory-wired, ready to install. Available in 3-foot lengths, 6 outlets on 6-inch centers . . . 6-foot lengths, 4 outlets on 18-inch centers.

**SNAPICOIL**

Outlet convenience by the yard! Coils of prewired receptacles, ready for quick installation. Available in four popular lengths, with brown or ivory receptacles.

When you plan electrical outlet convenience — in homes, offices and stores — look into the time-saving, business-building opportunities of the PLUGMOLD *trio*.

Interconnectable, three PLUGMOLD wiring methods are available with a wide range of factory-wired outlet spacings (or wiring may be done on the job, outlets placed exactly where needed) . . . *flexibility* to meet the specific requirements of every installation. A minimum number of well-designed fittings means savings in time and trouble.

And regardless of the PLUGMOLD method you select, you're assured of the same results . . . an installation that's neat, trim in appearance . . . outlet convenience that always has customer approval.

Important *reasons why* it will pay you to plan PLUGMOLD. For the complete facts, write today . . .

**THE WIREMOLD COMPANY**
**HARTFORD 10, CONN.**

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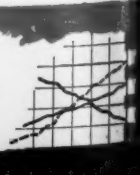
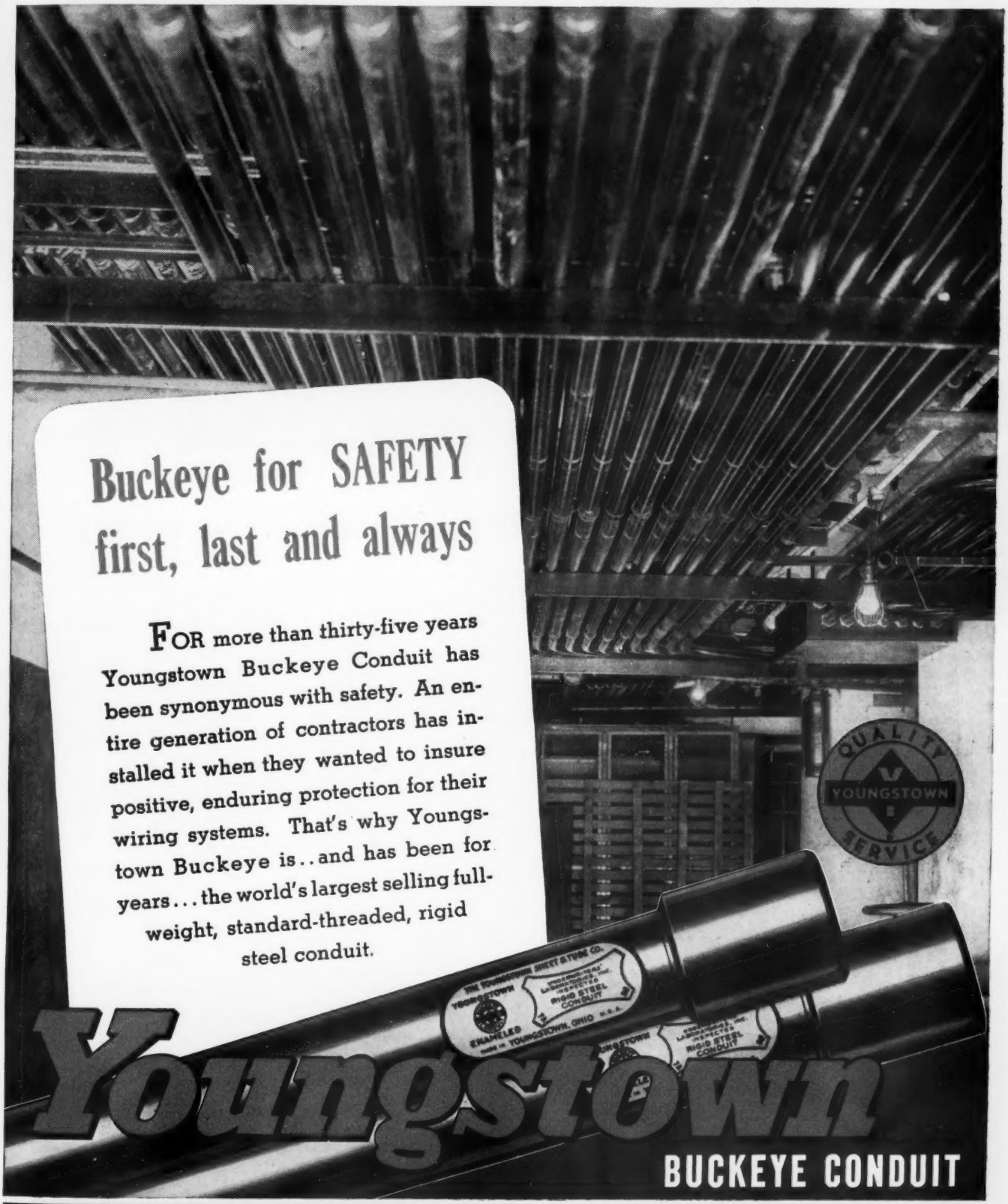


FOR SAFETY'S SAKE . . . USE CONDUIT *(Full Weight Rigid Steel)*




## Buckeye for SAFETY first, last and always

FOR more than thirty-five years Youngstown Buckeye Conduit has been synonymous with safety. An entire generation of contractors has installed it when they wanted to insure positive, enduring protection for their wiring systems. That's why Youngstown Buckeye is..and has been for years...the world's largest selling full-weight, standard-threaded, rigid steel conduit.

**Youngstown**

**BUCKEYE CONDUIT**

**THE YOUNGSTOWN SHEET AND TUBE COMPANY**

General Offices — Youngstown 1, Ohio

*Manufacturers of Carbon, Alloy and Yoloy Steel*

Export Office - 500 Fifth Avenue, New York

PIPE AND TUBULAR PRODUCTS - CONDUIT - BARS - RODS - COLD FINISHED CARBON AND ALLOY BARS - SHEETS - PLATES - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - TIE PLATES AND SPIKES.

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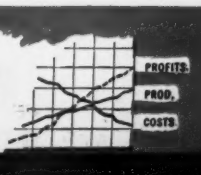

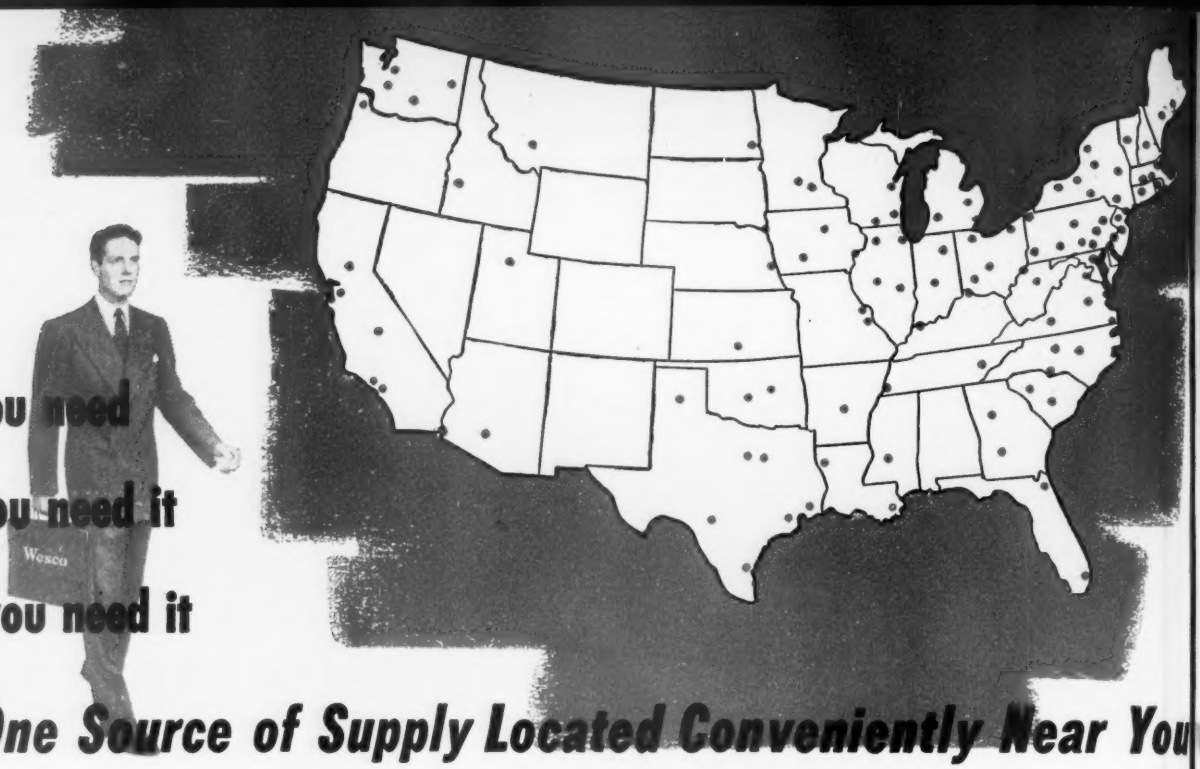

# What you need
# When you need it
# Where you need it

## *From One Source of Supply Located Conveniently Near You*

### CALL YOUR NEAREST **WESCO** BRANCH FOR EVERYTHING ELECTRICAL

Albany, Ga. ..... 667
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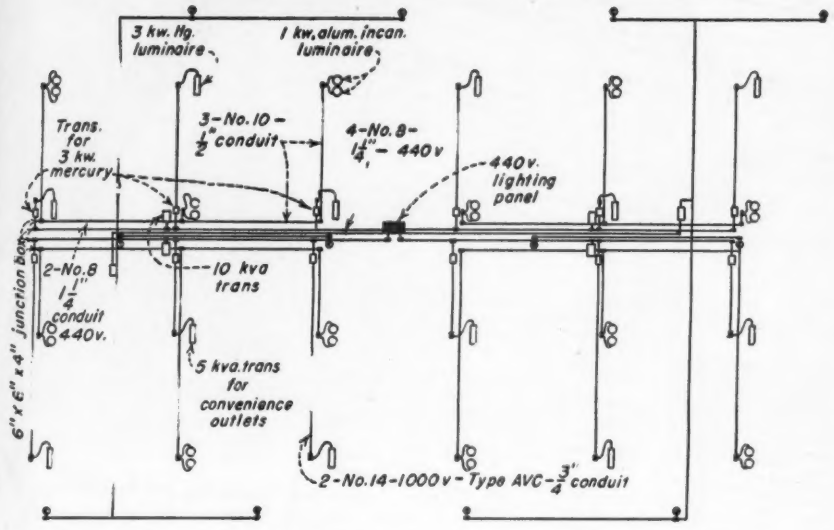
Allentown, Pa. ..... 4-5105
Amarillo, Texas ..... 26536
Atlanta 2, Ga. ..... Atwood 2721
Augusta, Me. ..... 2040-1
Baltimore 23, Md. ..... Longwood 4400
Bangor, Me. ..... 6487
Beaumont, Texas ..... 4-8635
Binghamton 60F, N. Y. ..... 4-1364
Boise, Idaho ..... Boise 7611
Boston 10, Mass. ..... Copley 7-1300
Brooklyn 16, N. Y. ..... Sterling 3-1700
Burlington, Vt. ..... 1924-5
Butte, Montana ..... 2-1269
Charlotte 1, N. C. ..... 5-3715
Chicago 7, Ill. ..... Taylor 9-5000
Cincinnati 6, Ohio ..... Capitol 1300
Clarksburg, W. Va. ..... 440
Cleveland 14, Ohio ..... Tower 1-5660
Columbus 16, Ohio ..... Main 5571
Columbia (A), S. C. ..... 8145
Corpus Christi, Texas ..... 2-3351
Dallas 1, Texas ..... C-2401
Danville, Ill. ..... 1901
Davenport, Iowa ..... 3-9966
Dayton, Ohio ..... Adams 6101
Des Moines 8, Iowa ..... 2-0244
Detroit 2, Mich. ..... Madison 8450
Duluth 3, Minn. ..... Melrose 6375
Erie 2, Pa. ..... 26-853
Evansville 8, Ind. ..... 5-7276
Fargo, No. Dak. ..... 4266
Flint 7, Mich. ..... 4-8623
Ft. Wayne, Ind. ..... Anthony 3421
Ft. Worth 1, Texas ..... 2-1106
Fresno 1, Cal. ..... 4-5091
Fyler, St. Louis 9, Mo. .. Sweetbriar 2000
Grand Rapids 2, Mich. ..... 9-3103
Green Bay, Wis. ..... Adams 783
Greensboro, N. C. ..... 3-8661
Greenville, S. C. ..... 3-6201
Hartford 3, Conn. ..... 2-9203
Hempstead, N. Y. ..... Olympic 8-5220
Houston 1, Texas ..... Capitol 7272
Indianapolis 9, Ind. ..... Market 3301
Jackson, Miss. ..... 4-8354
Jacksonville 3, Fla. ..... 5-7246
Johnstown, Pa. ..... 8-1293
Knoxville, Tenn. ..... 4-8644
Little Rock, Ark. ..... 2-5154
Los Angeles 54, Cal. .. Madison 9-4161
Madison 3, Wis. ..... Badger 4990
Manchester, N. H. ..... 5-5456
Memphis 1, Tenn. ..... 37-9431
Miami 4, Fla. ..... 3-7431
Milwaukee, Wis. ..... Daly 8-1800
Minneapolis 15, Minn. .. Lincoln 7-001
Newark 5, N. J. ..... Mitchell 2-3450
Newburgh, N. Y. ..... 5420
New Haven 8, Conn. ..... 5-5154
New Orleans 12, La. .... Magnolia 5652
New York, N. Y. ..... Watkins 4-9000
Norfolk 1, Va. ..... 5-0525
Oakland 6, Cal. ..... Templebar 4-9900
Oklahoma City 2, Okla. ..... 2-7101
Omaha 2, Nebr. ..... Harney 8-700
Peoria 2, Ill. ..... 3-5111
Philadelphia 7, Pa. ..... Walnut 8950
Phoenix, Ariz. ..... 4-9277
Pittsburgh 19, Pa. ..... Allegheny 5500
Portland 9, Oregon ..... Atwater 6411
Providence 1, R. I. .. Gaspee 6484-5-6-7
Raleigh, N. C. ..... 3-4841
Reading, Pa. ..... 7236
Richmond 19, Va. ..... 3-0111
Roanoke 4, Va. ..... 7771
Rochester 7, N. Y. ..... Monroe 1635
Rockford, Ill. ..... 4-8649
Sacramento 14, Cal. ..... Gilbert 3-6525
Salt Lake City 11, Utah ..... 5-2972
San Antonio 2, Texas ..... C-6216
San Francisco 1, Cal. .. Underhill 1-5051
Savannah, Ga. ..... 3-9682
Seattle 4, Wash. ..... Elliot 7001
Shreveport, La. ..... 3-0583
Sioux City 7, Iowa ..... 5-7634
Spokane 8, Wash. ..... Broadway 5409
Springfield 3, Mass. ..... 4-3101
St. Louis 2, Mo. ..... Central 4838
St. Paul 1, Minn. ..... Garfield 7441
Syracuse 4, N. Y. ..... 2-6158
Tacoma 2, Wash. ..... Main 4134
Tampa 1, Fla. ..... M-5595
Toledo 2, Ohio ..... Garfield 6184
Trenton 9, N. J. ..... 5-5421
Tulsa 3, Okla. ..... 37155-6-7-8
Utica 1, N. Y. ..... 4-8116
Vernon, Los Ang., Cal. .. Kimball 0141
Washington 5, D. C. ..... National 9700
Waterloo, Iowa ..... 4679
Watertown, N. Y. ..... 1400
Wheeling, W. Va. ..... 3980
Wichita 2, Kansas ..... 3-8215
Williamsport 1, Pa. ..... 2-6184
Wilmington 99, Del. ..... 5-9611
Worcester 4, Mass. ..... 3-7238
Yakima, Wash. ..... 6174
York, Pa. ..... 5569

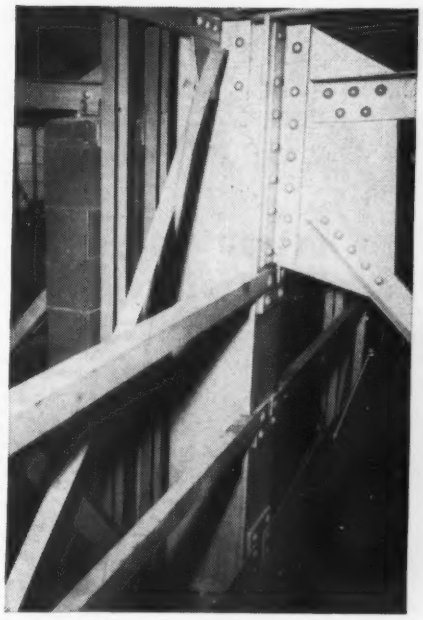
# Westinghouse Electric Supply Co.

A NATIONAL DISTRIBUTING ORGANIZATION WITH 109 BRANCHES

# Practical Methods


3 kw. Hg. luminaire
1 kw. alum. incan. luminaire
Trans. for 3 kw. mercury
3-No. 10 - 1/2" conduit
4-No. 8 - 1 1/4" - 440 v
440 v. lighting panel
2-No. 8 1" 1/4 conduit 440 v.
10 kva trans
5 kva. trans for convenience outlets
6" x 6" x 4" junction box
2-No. 14-1000 v - Type AVC - 3/4" conduit

*Circuit diagram of combination 3-kw. mercury and 1-kw. lighting installation on 440-volt panel control in mill building.*



*Transformers for 3-kw. mercury and incandescent fixtures are mounted to catwalk rail for service accessibility.*

## 440-Volt Control For Hi-Bay Lighting

WIRING DESIGN

General lighting at the Aluminum Company of America's Davenport, Iowa, plant consists of three different types. In the high bay areas of the main mill building, a staggered system of 3-kw. mercury and 1-kw. incandescent fixtures is installed. A similar system of 400-watt mercury and 750-watt incandescent units is used in the heat treat, finishing and other manufacturing areas. Illumination for inspection areas is provided by continuous rows of industrial type fluorescent units (four 100-watt lamps per 11-ft. fixture) on 20-foot centers. All fixtures are mounted to the steel truss chords by special clamp-on brackets that facilitate fixture removal and maintenance.

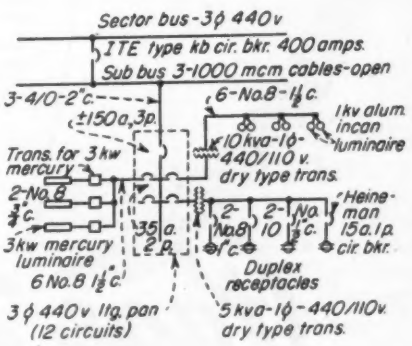
All lighting circuits are fed by dry type transformers mounted in the roof truss areas and on the side of the mill building catwalks. Control panels are on mill floor columns for easy access. All conductors are aluminum with Neoprene jacket with the exception of the No. 10 bare, solid aluminum neutral. Power source is the 440-volt, three-phase feeder circuit in each respective area.

The 440-volt primary on the 3-kw. mercury unit transformers dictated 440-volt panel control of these lighting fixtures in the high bay area. To simplify the circuits and provide additional conductor economy, the 440-volt control was extended to the 1-kw. incandescent and duplex receptacle outlet systems in the same area. Mounted at accessible height on mill floor columns, these panels contain a main 440-volt, 3-pole circuit breaker and 12 2-pole branch circuit breakers of suitable rating. To facilitate pulling around the necessary offsets and bends, No. 8 strand, insulated aluminum conductors were used for the branch circuits instead of the No. 10 minimum specified.

Typical circuit design for the 1-kw. high-bay incandescent units incorporates a 440-volt branch circuit from the panel to a 10-kva., single-phase, 440/110-volt dry type transformer mounted on the roof truss or service catwalk. From the secondary side, 110-volt circuits feed six 1-kw. fixtures.

A similar scheme is used for duplex receptacles. Here a 5-kva. dry type, single-phase, 440/110-volt transformer is used for every five or six duplex receptacles. Single-pole, 110-volt, 15-amp. circuit breakers above each receptacle provides individual control and protection.

For the 3-kw. mercury units, branch circuits control groups of three fixtures with individual fixture transformers mounted to the catwalk rail opposite the fixture location. Area control of lighting is provided by this method, as


Sector bus - 3φ 440 v
ITE type kb cir. bkr. 400 amps.
Sub bus 3-1000 mcm cables-open
3-4/0-2"c.
±150 a, 3p.
6-No. 8-1 1/2 c.
1 kw alum. incan luminaire
10 kva-1φ-440/110 v. dry type trans.
Trans. for 3 kw mercury
2-No. 8 3/4" c.
3 kw mercury luminaire
6 No. 8 1 1/2 c.
35 a. 2 p.
2-No. 8 1/2" c.
2-No. 10 1/2" c.
Heine-man 15 a. 1 p. cir. bkr.
Duplex receptacles
3φ 440 v ltg. pan (12 circuits)
5 kva-1φ-440/110 v. dry type trans.

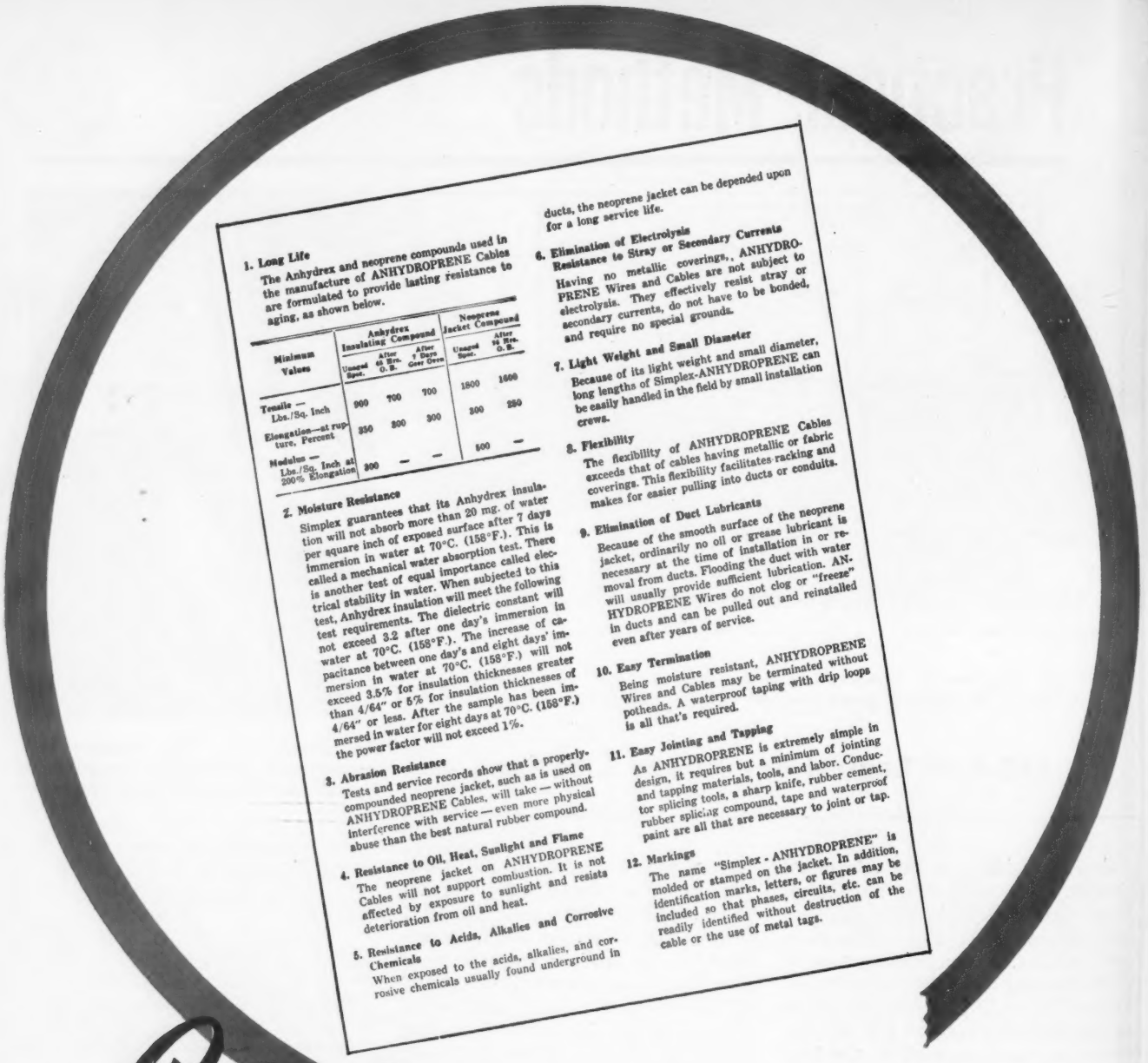
*Schematic diagram of 440-volt lighting control for high bay areas at ALCOA's Davenport plant. Used primarily where 3-kw. mercury and 1-kw. incandescent staggered system is installed.*

operation of a branch circuit breaker in the panel cuts the primary of the transformer feeding groups of units as outlined.

## Mobile Scaffolds Aid Maintenance

MAINTENANCE

Scaffolding plays an important part in New York City's Rockefeller Center, where much of the electrical equipment and lighting units are in hard-to-reach locations and where ceiling heights



**1. Long Life**

The Anhydrex and neoprene compounds used in the manufacture of ANHYDROPRENE Cables are formulated to provide lasting resistance to aging, as shown below.

| Minimum Values | Anhydrex Insulating Compound | | | Neoprene Jacket Compound | |
|---|---|---|---|---|---|
| | Unaged Spec. | After 48 Hrs. O. B. | After 7 Days Geer Oven | Unaged Spec. | After 96 Hrs. O. B. |
| Tensile — Lbs./Sq. Inch | 900 | 700 | 700 | 1800 | 1600 |
| Elongation—at rupture, Percent | 350 | 300 | 300 | 300 | 250 |
| Modulus — Lbs./Sq. Inch at 200% Elongation | 800 | — | — | 800 | — |

**2. Moisture Resistance**

Simplex guarantees that its Anhydrex insulation will not absorb more than 20 mg. of water per square inch of exposed surface after 7 days immersion in water at 70°C. (158°F.). This is called a mechanical water absorption test. There is another test of equal importance called electrical stability in water. When subjected to this test, Anhydrex insulation will meet the following test requirements. The dielectric constant will not exceed 3.2 after one day's immersion in water at 70°C. (158°F.). The increase of capacitance between one day's and eight days' immersion in water at 70°C. (158°F.) will not exceed 3.5% for insulation thicknesses greater than 4/64" or 5% for insulation thicknesses of 4/64" or less. After the sample has been immersed in water for eight days at 70°C. (158°F.) the power factor will not exceed 1%.

**3. Abrasion Resistance**

Tests and service records show that a properly-compounded neoprene jacket, such as is used on ANHYDROPRENE Cables, will take — without interference with service — even more physical abuse than the best natural rubber compound.

**4. Resistance to Oil, Heat, Sunlight and Flame**

The neoprene jacket on ANHYDROPRENE Cables will not support combustion. It is not affected by exposure to sunlight and resists deterioration from oil and heat.

**5. Resistance to Acids, Alkalies and Corrosive Chemicals**

When exposed to the acids, alkalies, and corrosive chemicals usually found underground in ducts, the neoprene jacket can be depended upon for a long service life.

**6. Elimination of Electrolysis Resistance to Stray or Secondary Currents**

Having no metallic coverings, ANHYDROPRENE Wires and Cables are not subject to electrolysis. They effectively resist stray or secondary currents, do not have to be bonded, and require no special grounds.

**7. Light Weight and Small Diameter**

Because of its light weight and small diameter, long lengths of Simplex-ANHYDROPRENE can be easily handled in the field by small installation crews.

**8. Flexibility**

The flexibility of ANHYDROPRENE Cables exceeds that of cables having metallic or fabric coverings. This flexibility facilitates racking and makes for easier pulling into ducts or conduits.

**9. Elimination of Duct Lubricants**

Because of the smooth surface of the neoprene jacket, ordinarily no oil or grease lubricant is necessary at the time of installation in or removal from ducts. Flooding the duct with water will usually provide sufficient lubrication. ANHYDROPRENE Wires do not clog or "freeze" in ducts and can be pulled out and reinstalled even after years of service.

**10. Easy Termination**

Being moisture resistant, ANHYDROPRENE Wires and Cables may be terminated without potheads. A waterproof taping with drip loops is all that's required.

**11. Easy Jointing and Tapping**

As ANHYDROPRENE is extremely simple in design, it requires but a minimum of jointing and tapping materials, tools, and labor. Conductor splicing tools, a sharp knife, rubber cement, rubber splicing compound, tape and waterproof paint are all that are necessary to joint or tap.

**12. Markings**

The name "Simplex - ANHYDROPRENE" is molded or stamped on the jacket. In addition, identification marks, letters, or figures may be included so that phases, circuits, etc. can be readily identified without destruction of the cable or the use of metal tags.

**Page 2** of the new Simplex Bulletin 115 lists twelve big reasons why Simplex-ANHYDROPRENE Cables can be relied upon for low-cost installation, trouble-free service and long life. They are twelve of the many advantages these cables provide through the combination of Anhydrex insulation and a neoprene jacket.

Yet even they are only a part of the valuable information this bulletin contains. You ought to know about it for it shows the way to low-cost, thoroughly-dependable transmission and distribution systems.

If you're not up-to-date on ANHYDROPRENE Cables, or are not aware that a cable consisting only of conductor, insulation, and a thin jacket can provide the electrical stability, mechanical toughness, and versatility that efficient systems demand, it will pay you to read Bulletin 115. Why not drop us a line today for your copy?

**Simplex WIRES & CABLES**

**SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.**

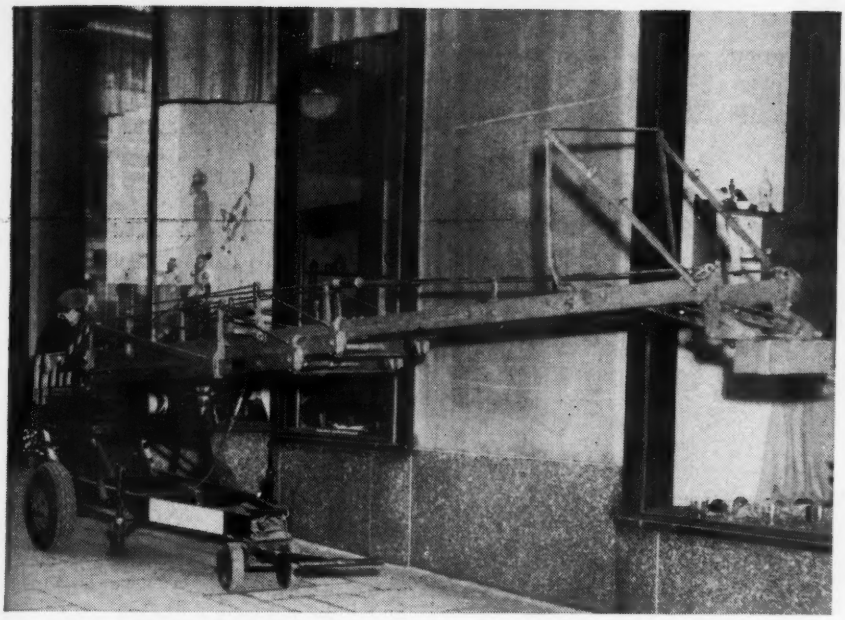


*FIG. 1—Truck-mounted extension ladder has many maintenance applications and is rubber-tired for easy manual movement. Hand crank and winch controls angle of inclination and length of ladder. In lowered position, truck easily passes through main entrances.*

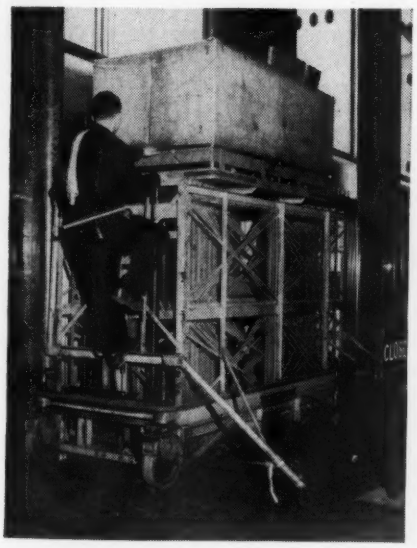


*FIG. 2—Telescopic work tower is chain-raised to maximum height of 49 feet for maintenance work in the 4-story lobbies of Rockefeller Center, yet can be lowered to a compact assembly and carried on freight elevators.*

*FIG. 3—Level working platform, steel body guard around maintenance man, and suspended tool box for lamps or other small items gives comfort, safety and convenience to worker at intermediate heights.*

range up to four stories. To relamp fixtures in these locations and to clean, repair, replace or install electrical equipment, scaffolding is essential and several types of mobile towers and ladders are included in the maintenance department's store room for this purpose.

For work in the high lobbies, a 49-foot telescopic tower, Fig. 2, is utilized. This chain-driven, ten-section tower is fitted with a parapet platform for the safety of men working at high elevations, and the structure can be lowered so that the castor-mounted structure can pass through main entrances and be carried on standard freight elevators.

For work at intermediate heights, a hand-truck mounted extension ladder, Fig. 1, is of definite assistance, for the ladder can be raised into any desired working position at any inclination, or lowered for storage or passage through small structural openings. As indicated in Fig. 3, safety is provided by the steel frame which surrounds the body of the worker. The working platform can be adjusted so that it is level for all inclinations of the ladder, and the small box at the extreme end of the frame is shaftmounted so that it, also, remains constantly level and holds tools, lamps or other small items securely.

In areas where working heights are still lower, light-weight aluminum ladders and sectional scaffolding provides ready access for maintenance personnel.

## Autotronic Control Is New Elevatoring Concept

VERTICAL TRANSPORTATION

Employing electronic control and automatic principles, a fundamentally new concept of elevator travel has been developed by the Otis Elevator Company after a decade of research and experimentation. And, since efficient elevator service is measured by fast rides and short waiting periods, this new dispatching system should merit attention.

Dispatching has used many techniques to keep pace with the changing requirements of faster service; beginning with a hand-operated buzzer or clicker, progressing to lobby panels showing car movements and recorded calls, and recently introducing automatic systems for dispatching cars at regular intervals. None of these methods, however, relieved the starter of having to constantly analyze his car spacing and traffic demands.

With autotronic elevatoring, manual adjustments are taken out of the starter's hands, and dispatching, car spacing and passenger waiting time are automatically controlled. Essentially, such an elevator installation includes electronic signal control elevators, standard controller panels, an electronic panel and an autotronic dispatching panel. On this last panel, electron tubes set up electronic circuits that actuate electro-magnetic switches and relays on the individual elevator panels, resulting in group coordination. As an example: during rush periods, passenger waiting times are automatically measured by condensers and, when the voltage of a single condenser builds up to a predetermined point, an electrical impulse is sent to the dispatching panel and the operation of the individual elevators is fitted to the existing traffic situation. When passenger waiting time on several lower floors reach a certain level without car pick-up, some of the cars in service are automatically dispatched to this lower zone in the shaft and this arrangement continues until calls from

# This Trouble-Free PIPE WRENCH Saves Time and Money

**RIDGID's guarantee means no pipe wrench housing expense—ever**

● No time out for pipe wrench housing repairs and expense with the guaranteed RIDGID. Sturdy construction and work-saver features make it on-the-job always, make jobs easier, too. Adjusting nut spins freely in all sizes, 6" to 60." Handy pipe scale on hookjaw. Instant action non-slip, non-lock jaws. Powerful comfort-grip I-beam handle with flared end that keeps your hand from slipping off. It's the world's most popular wrench for good reasons.... Buy RIDGID wrenches at your Supply House.

RIDGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL CO. • ELYRIA, OHIO


the lower floors drop off. The system then automatically readjusts itself.

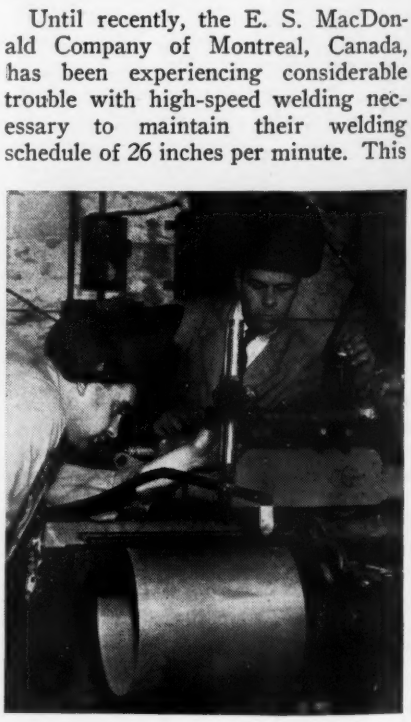
Otis claims that service will be speeded and the overall capacity of elevator groups will be increased. Buildings will be emptied more quickly during rush hours. The human factor of dispatching will be practically removed and scheduling will be coordinated with exact traffic demands. Passengers will not be forgotten and special service will be directed to anyone waiting for a predetermined interval. Six basic kinds of traffic will be handled efficiently; including heavy down movement at the start of the lunch period, heavy up movement after lunch, up peaks at the beginning of the business day, down peaks at the day's end, equal up and down traffic during mornings and afternoons, and night or holiday service.

With two dials on the elevator starter's lobby panel—one having six positions corresponding to the six traffic conditions, and the other adjustable so that dispatch intervals can be regulated—requirements can be hand set and, after that, signal devices in the machine room are automatically activated.

## Inert-Arc Welds For Aluminum

WELDING

Until recently, the E. S. MacDonald Company of Montreal, Canada, has been experiencing considerable trouble with high-speed welding necessary to maintain their welding schedule of 26 inches per minute. This



***Inert-arc welder, using 5 liters of argon gas per minute at 60 amperes, maintains welding-speed of 26 inches a minute. This G. E. unit is used by MacDonald Company of Montreal in manufacture of 5-gallon aluminum cans.***

schedule was established in order to fill an order for a million 5-gallon aluminum cans, to be manufactured within a 10-month period, to be used for the transportation of acid from Montreal to a rubber plantation in the Malay States. This called for the completion of 25,000 cans a week.

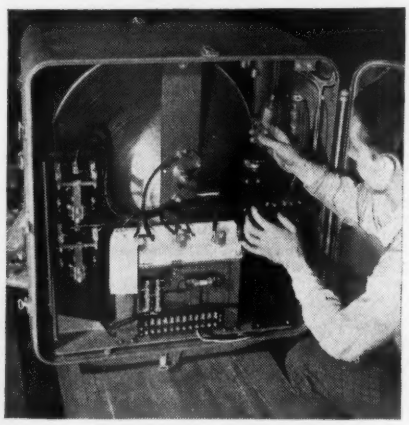
After considerable experimentation, the required speed was obtained satisfactorily by using two G. E. Type WP Inert-Arc welders, using 5 liters of argon gas per minute at approximately 60 amperes. The electrodes are of tungsten, having diameters of 3/32-inch. The material being welded is Type 57-SH aluminum, with a thickness of .032-inch.

Welds are sound, with 100 percent penetration, and a welding speed of 26 inches a minute is being maintained.

## Idlewild Airport Installs Electronic Flashers

SAFETY

The all-weather approach lighting system at New York City's mammoth Idlewild Airport utilizes 3.3-billion candlepower krypton lights for flashing predetermined sequences of signals. Weatherproof housings encase lamps,



***Electronic timing system, installed in the weatherproof case that houses lamp, reflector and flasher, controls sequence flashing of 3.3-billion candlepower krypton lights used in approach lighting system at Idlewild Airport.***

reflectors and electronic timers that control the sequencing of flashes. The Idlewild system, the first complete installation of its kind at any airport, depends upon electronic elements built and tested by the Westinghouse control division in Buffalo. The final assembly is at the Cleveland lighting division.

***Don't Miss the New***

**READER SERVICE page 159**

**Only ELECTROMODE has the LIFETIME HEATING ELEMENT!**

THERE'S no space-heating problem an Electromode cannot solve. Wherever heat is needed—in factory, office, shop, shipping room or locations isolated from the main heating system—Electromode is the safe, economical answer. For only Electromode has the patented heating element that *lasts a lifetime . . .* and *eliminates all danger of fire, shock or burn!*

With only a minimum of care, Electromode Unit Heaters will practically last forever. They require no plumbing, no ductwork, and almost no maintenance. Capacities from 1.5 to 45 KW. Portable and built-in-wall models for home or office. Approved by Underwriters' Laboratories. Contractors—see your electrical wholesaler or write Electromode for further information.

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# *Announcing*...THREE

## NEW! S-34 KIT

### *A New Hydraulic*
### "REMOTELY-CONTROLLED"
### THIN-WALL CONDUIT BENDER!

- **Famous "Porto-Power" furnishes "all directional" action**
- **Remote operation permits you to sight the bending from any angle — while operating**
- **This low-cost, portable equipment will pay for itself on one good job**

Now you can bend thin-wall conduit efficiently and profitably! And your work rushes along faster and better than with any other bending equipment—thanks to advantages you get exclusively with the Blackhawk "Porto-Power" hydraulic unit. Make dramatic savings in materials by substituting beautiful, kinkless bends for costly elbows and fittings. You'll boost your reputation even higher, too, with *rigid* installations and well-matched, graceful offsets. Investigate today—and use this equipment on your very next job!

**BEND 1¼, 1½, 2" THIN-WALL CONDUIT** — the S-34 KIT includes the 10-ton capacity "Porto-Power" hydraulic unit and all necessary attachments. IMPORTANT — this same "Porto-Power" is also used in the S-30A Rigid Pipe Bender (see bottom of page). **S-30A owners need only add the S-35 assortment of attachments to handle thin-wall conduit!**

Truly portable! Note how you can sight progress of the bending from the most convenient spot *because the pump is not integral with the hydraulic ram.*

## *Use Blackhawk All the Way for Faster Conduit Installation*

### S-30A KIT BENDS 1" TO 2" RIGID CONDUIT

Thousands own this ass't. It contains the same 10-ton "Porto-Power" hydraulic unit which serves Thin-Wall attachments (see above).

### S-36 KIT BENDS 1¼" TO 4" RIGID CONDUIT

This super-range bender uses the "Porto-Power" hydraulic unit of 20-ton capacity. "Porto-Power" also pulls drive pulleys, lifts machinery, etc.

### MOTORIZE YOUR EQUIPMENT

Triple your output! Hundreds are now substituting the low-cost, electrically-driven "Porto-Power" pump (No. P-182) for hand-operated pumps on benders, punch-kits and other hydraulic equipment.

# GREAT TIME SAVERS

**BLACKHAWK BRINGS YOU**

## HYDRAULIC KNOCK-OUT PUNCHES!

- Easier • Spectacularly faster • Makes clean, true holes
- Operates in closer quarters because there is no wrench to swing
- No distortion or loosening of boxes
- Punch the heaviest box with little effort

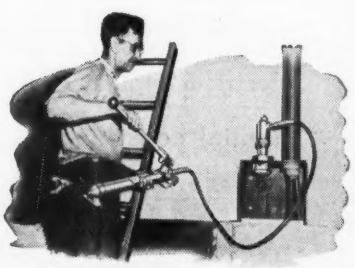
At last you can punch conduit openings in pull boxes, electrical distribution cabinets, control boxes, troughs, panels, etc., with portable *hydraulic* power! There is no wrench to swing. *One man* can punch holes up to 4" diameters. And when the punch breaks through there is no jostling . . . nor is footing endangered as when tugging on a wrench. Startling benefits make it good business to *buy immediately!*

NEW! SB-40 KIT

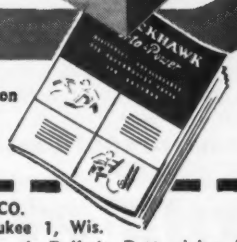
**PUNCHES 6 OPENING-SIZES** — ½, ¾, 1, 1¼, 1½, 2". Complete metal kit contains knock-out punches and new-type Blackhawk "Porto-Power" pull-ram. Used with same Porto-Power pump and fittings which serve Blackhawk benders.

NEW! SB-41 KIT

**PUNCHES 10 OPENING-SIZES** — ½, ¾, 1, 1¼, 1½, 2, 2½, 3, 3½, 4". Identical to SB-40 above but includes larger ass't of knock-out punches. New-type pull-ram also lifts transformers, pulls bearings — has many other uses.



Look how simple it is to punch a hole in a cramped corner. No wrench to swing . . . just a few smooth strokes on the hydraulic pump — and the hole is punched!



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# BLACKHAWK®

HYDRAULIC *Porto-Power*® EQUIPMENT

Many say, "Porto-Power Equipment PAYS FOR ITSELF ON THE FIRST JOB!" Blackhawk is the *world's largest maker of high-pressure hydraulic equipment* and specializes in producing time-saving hydraulic tools for electricians. Buy from your Electrical Wholesaler or Industrial Supply Distributor.

BLACKHAWK MFG. CO.
Dept. P20109, Milwaukee 1, Wis.
Without obligation, rush Bulletin B-50 giving full details and prices on Electrician's Equipment.

NAME.....

FIRM.....

ADDRESS.....

CITY.....STATE.....

# EXPLOSION-PROOF PYLETS

## ... for Hazardous Locations

**EXPLOSION-PROOF SWITCH PYLETS**

**1. *TUMBLER SWITCHES with push-pull Rod*** to control motors or lighting circuits in hazardous locations. 1 and 2 gang, 1, 2 and 3-pole, 10 to 30 ampere, also 3 way and 4 way, 10 and 20 ampere types.

**2. *TUMBLER SWITCHES with interlocking Plug*** Receptacle for use as service outlets for portable electrical equipment in hazardous locations. Plugs cannot be inserted or withdrawn unless switch is open. Switch cannot be closed unless plug is fully inserted. 2 and 3-pole, 20 and 30 ampere, 250 and 460 volt ratings.

**3. EXPLOSION-PROOF SECONDARY CIRCUIT BREAKER PYLETS** for protection of motors against overloads and stalled rotor currents. Can also be used for "on" and "off" switch. Single and double pole with a selection of interchangeable heater units for protecting fractional horsepower motors.

**4. EXPLOSION-PROOF UNIVERSAL JUNCTION PYLETS**—6, 7 and 10 hub types with close-up plugs. For easy replacement of sheet metal knockout boxes in the rewiring of old gasoline pump installations.

**5. EXPLOSION-PROOF JUNCTION PYLETS** available in a wide selection of styles and sizes with threaded or union type hub. Furnished with plain covers for general use or with covers tapped for conduit to support lighting fixtures. Also furnished with pipe plug angle type cover for filling with sealing cement.

**6. PYLE-O-FLEX** flexible explosion-proof and watertight fittings for adjustable and vibrative connections to motors, floodlights and pendant type lighting fixtures. Furnished in any combination of male and female threaded or female union type end connections with flexible lengths of 4 to 36 inches, conduit sizes ½" to 2" inclusive.

**7. EXPLOSION-PROOF SEALING PYLETS** have removable pipe plug covers which can be mounted in any one of four positions for filling with cement. Used to isolate the wiring compartments of arc-producing devices from balance of conduit system.

**EXPLOSION-PROOF UNIONS,** male and female, straight and 90° elbow types.

A line of the most commonly used types of conduit fittings for hazardous locations as defined in Article 500 of The National Electrical Code. Explosion-proof Pylets are designed in accordance with Underwriters' Laboratories requirements and are classified in their list of inspected electrical appliances. Their substantial construction and the high quality of materials and workmanship insure safety, uninterrupted service and long life. Consult your Pylet Catalog 1100 for complete listings of the above and other Explosion-Proof and Dust-Tight Pylets.

## THE PYLE-NATIONAL COMPANY

SINCE 1897

1344 NORTH KOSTNER AVENUE, CHICAGO 51, ILLINOIS

DISTRICT OFFICES and REPRESENTATIVES in Principal Cities of the United States

EXPORT DEPARTMENT: International Railway Supply Co., 30 Church St., New York • CANADIAN AGENT: The Holden Co., Ltd., Montreal

PLUGS and RECEPTACLES • FLOODLIGHTS • TURBO-GENERATORS • LOCOMOTIVE HEADLIGHTS • MULTI-VENT AIR DISTRIBUTION

# Industrial Electrification

## Underfloor Distribution—Part II

**The advantages, design, layout and specification of underfloor wiring systems are analyzed for the electrical contractor, engineer, building owner and tenant.**

THE design of an underfloor distribution system depends upon two important factors. First, the type of floor construction must be considered, for the specification of standard or special duct components, assembly parts and service fittings will vary slightly with these initial conditions. However, with today's comprehensive range of raceway accessories, duct systems are readily adaptable to: (1) bar joist construction (with a monolithic slab on steeltex metal lath, supported by bar joists), (2) cellular steel flooring, (3) metal form construction (utilizing reinforced concrete joist slabs, poured over permanently-positioned or removable metal pans), (4) standard monolithic or concrete slab construction, and (5) all types of wood bases. With this installational versatility available, the outlet and circuit requirements of both new and old buildings can be satisfied.

Second, the proposed use and layout of the space is important, for upon this factor will depend the number and size of ducts installed and the density of distribution. In considering these latter conditions, it is rarely an economically-sound policy to provide for all possible furniture and equipment layouts, but all reasonable probabilities should be contemplated.

### *Designing the System*

In general, floor layouts can be classified in one of four divisions.

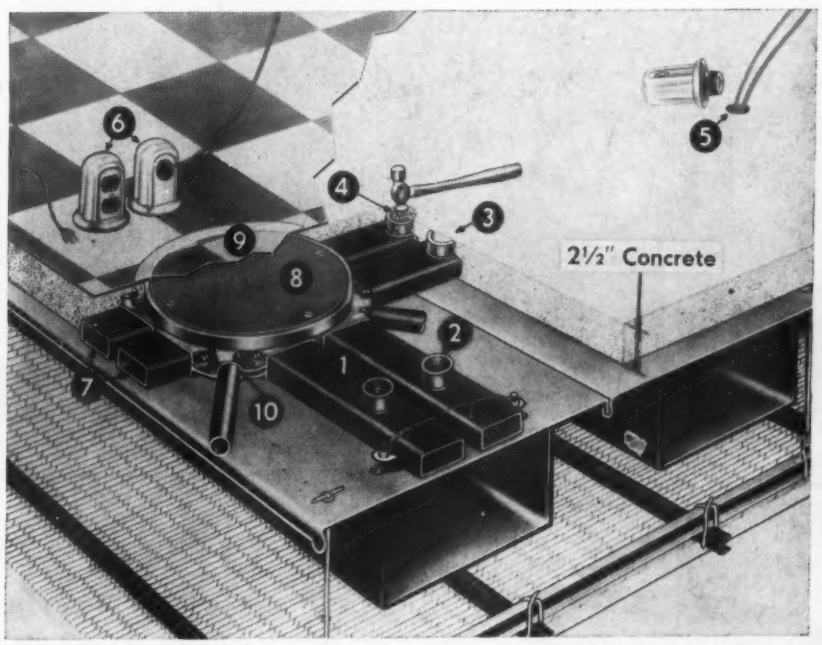
The first division provides for full coverage of the entire net usable floor area, making provision for all requirements during the lifetime of the structure.

Next, we find those buildings in which full coverage is desired for certain portions of the floor area where demands for service will be greatest. These systems have somewhat less scope but will render acceptable service without creating major inconveniences.

The third classification calls for a perimeter system which merely removes wall receptacles and corridor mouldings, relocating these utilities in the floor rather than on walls. By locating the underfloor systems adjacent to walls, however, where service demands normally are greater, flexibility and economy can be obtained for those areas subdivided into small units. By locating wireways in the floor, continuity of service and neatness of appearance will be maintained regardless of subsequent changes in partitioning and, by following outside walls, desk occupants will have the added comforts of natural light and ventilation.

The fourth division includes special layouts, such as banking areas and stores, where distribution is planned to serve specific furniture or equipment placements not subject to frequent rearrangements. In this division, particular attention is paid to the character of the services required, providing full coverage of usable areas and bypassing such areas as exist immediately in front of elevator banks and entrances.

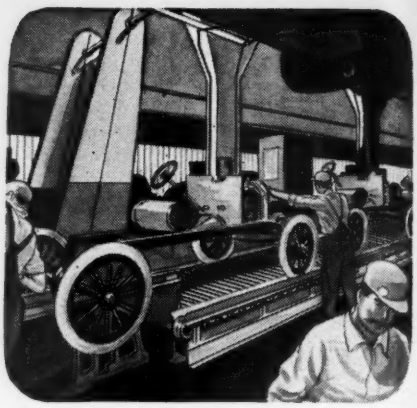
Since greater duct capacity is nor-




***PHANTOM VIEW** of duct junction, installed over steel deck flooring, shows a standard threaded outlet (1) for service fitting or other connection. Outlets are capped at the factory (2) so that concrete floor finishes will be excluded from channels (3). However, when outlet is required for service, a sharp hammer blow (4) will crush this overlying concrete, permitting the pulling of conductors (5) and the installation of the service fitting required (6). Ducts (7) enter junction box (8) which, in this case, is capped by a top designed with a linoleum pan (9). Branch circuits and conduits to distribution center are connected through slip type conduit hubs (10).*

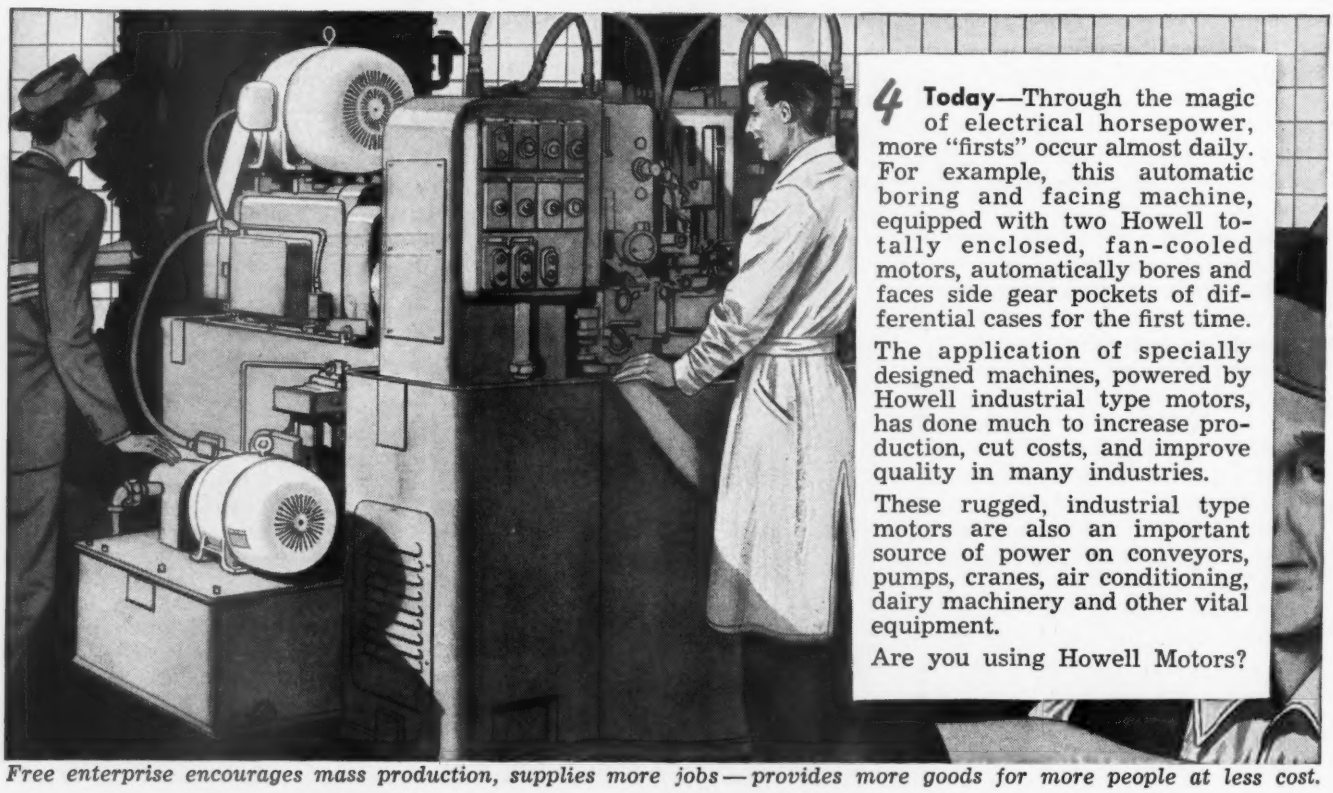
**1** **1875**—Wisconsin offered a $10,000 reward to the person who would invent a steam carriage. George Seldon, Rochester, N. Y., was first and collected . . . America's great auto industry was under way.

**2** **1892**—First gasoline-driven car was built by Charles Duryea with screw drivers and wrenches. Machine tools to aid this growing industry soon appeared. But parts still had to be assembled by hand.



**3** **1913**—First moving assembly line was used in auto plants! Gone, now, was much of the labor of carrying parts. In 1915, Howell "Red Band" Motors appeared and soon were widely accepted in industry.

# FAMOUS AUTOMOTIVE FIRSTS! REMEMBER?



**4** **Today**—Through the magic of electrical horsepower, more "firsts" occur almost daily. For example, this automatic boring and facing machine, equipped with two Howell totally enclosed, fan-cooled motors, automatically bores and faces side gear pockets of differential cases for the first time.

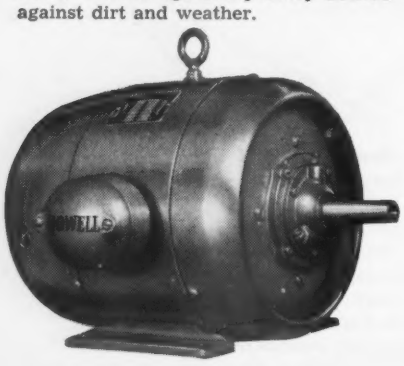
The application of specially designed machines, powered by Howell industrial type motors, has done much to increase production, cut costs, and improve quality in many industries.

These rugged, industrial type motors are also an important source of power on conveyors, pumps, cranes, air conditioning, dairy machinery and other vital equipment.

Are you using Howell Motors?

*Free enterprise encourages mass production, supplies more jobs — provides more goods for more people at less cost.*

Howell totally enclosed, fan-cooled motor—windings completely sealed against dirt and weather.



## HOWELL MOTORS

**HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.**

***Precision-built Industrial Motors Since 1915***

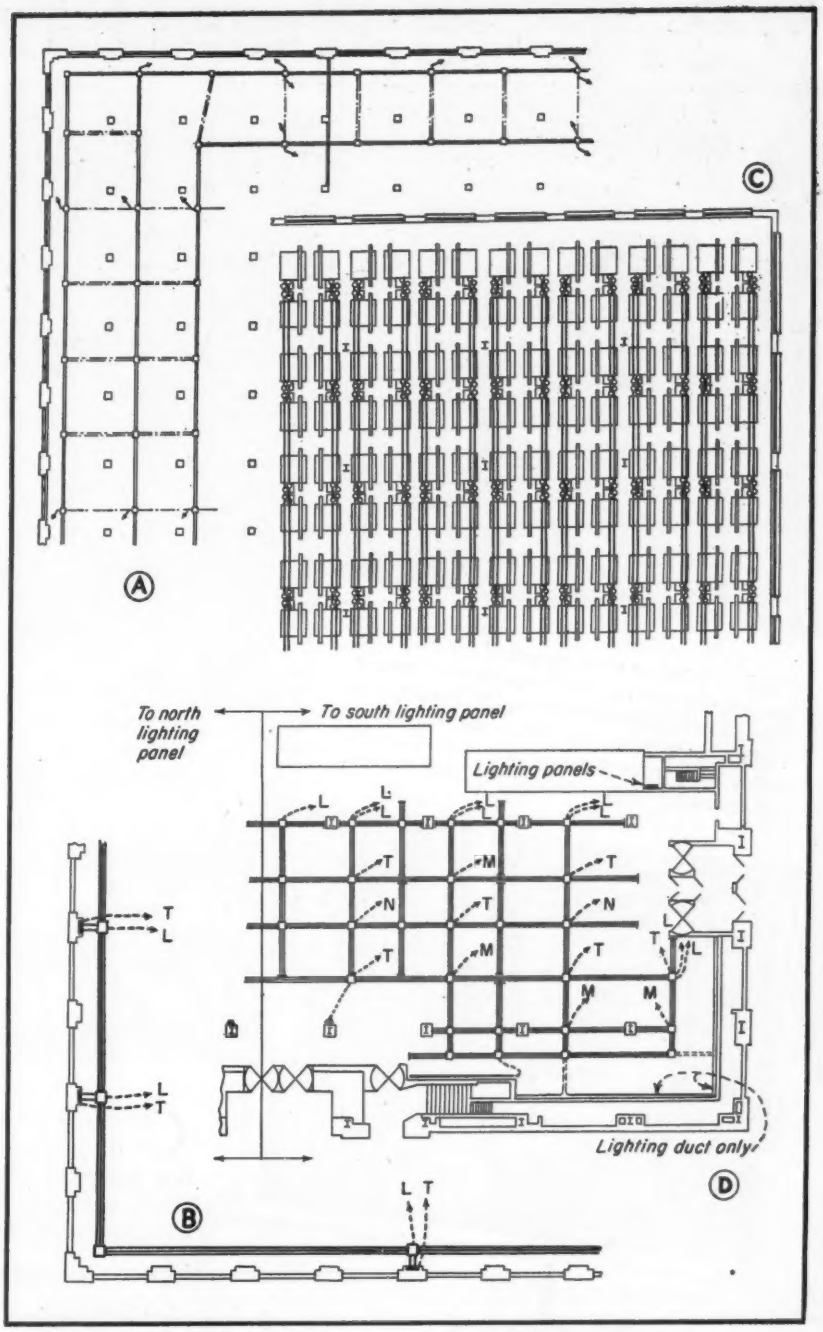
HOWELL Red Band MOTORS

mally required for the distribution of low potential wiring, it was originally common practice to use a larger duct size for such systems. However, the difference in cost between two sizes of duct is so small that the present trend is to install the larger ducts for both 110/220-volt systems and low potential wiring. This has several distinct advantages, for it eliminates two types of duct in the job, reduces the number of items to be specified and stocked, provides greater advantages in wire pulling, and facilitates accurate design and estimating.

The number of ducts in each run is dependent upon the number of services as well as the volume of service requirements. Some buildings utilize a single duct system for either telephone service or for lighting and small power requirements. Other structures employ a double duct for the two systems, complying with the ruling of the National Electrical Code for segregating high and low potential circuits. Where low potential traffic justifies an additional duct, a triple duct system is used so that buzzers, intercommunication systems and bells can be adequately serviced. Where capacity requirements exceed the limits of three ducts, it is becoming standard policy to reduce the spacing between parallel runs rather than increase the number of ducts per run beyond three.

In the triple-duct systems, lighting circuits usually occupy the central channel, for it is in the interest of installational and maintenance efficiency to install that system having the fewest number of wires in the channel having the most confined position. Telephone wiring is carried in one of the outside ducts, promoting more reliable service and segregating the wiring falling under the maintenance jurisdiction of the local telephone company. The other outside duct is used for miscellaneous signal systems.

After parallel runs are laid out in accordance with service requirements and area use, cross runs and junction boxes are determined by volume of demand and the location of distribution centers. At building corners, where parallel runs in one direction meet or intersect parallel runs in another direction, it is recommended that a junction box be installed at each of these points. Also, to facilitate wire pulling, boxes are installed along long runs at intervals of 40 or 50 feet. With this network, it is then possible to connect duct systems with the nearest distribution centers, running feeder wires from convenient junction boxes in 1- or 1¼-inch conduit. Feeders between distribution centers and underfloor grids should be of sufficient number so that current capacity is adequately provided, and so that congestion of wires in intermediate junction boxes is eliminated.




***FLOOR DUCT LAYOUTS** follow several standard patterns, including full wiring coverage for certain local areas (a), limited perimeter wiring (b) general coverage for the entire area (c) and specific requirements for banks, etc. (d).*

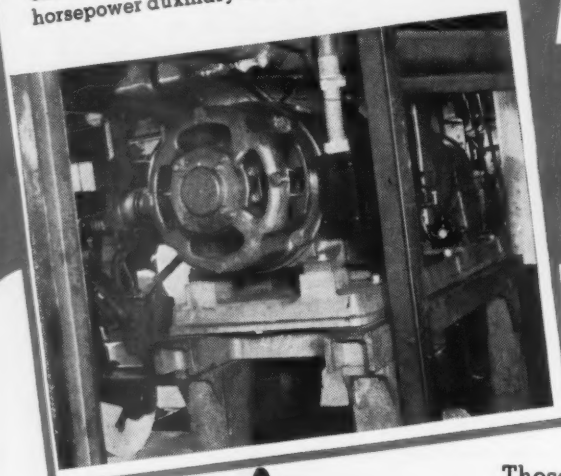
### *Installation Procedures*

Either of two methods may be followed when installing underfloor systems, the first being particularly efficient when working in small areas.

Two datum lines are established, stretching one line at finished floor height along the first row of junction boxes, and stretching the second line at right angles to this row, bisecting the area to be served. All measurements should be recorded in relation to these two base lines. After obtaining accurate levels for the finished cement flooring, frequent marks should be made on convenient columns and walls for reference purposes, and junction boxes should then be positioned and carefully leveled to coincide with the finished floor elevation. When boxes have been grouted into place, ducts and duct supports are installed between boxes, ducts are accurately lined up for both elevation and direction, and supports are anchored securely to the base slab. Insert tops should be leveled either to the finished floor level

# Century Wound Rotor Motors

Tandem printing press powered by two 150 horsepower and two 100 horsepower Century Wound Rotor Type SR Motors. 150 horsepower motors usually operate the press—but when extra color rolls are put into use, the 100 horsepower auxiliary motors go into operation.



## Provide POWER and FLEXIBILITY for Large Equipment

Century Wound Rotor Type SR Motors are available for many applications, such as the printing presses shown here, plus compressors, cranes, hoists, bending rolls, bridges, syncro-speed drives, etc.

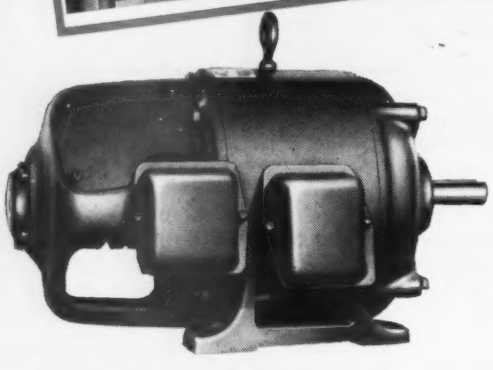
These motors are adaptable to applications that require

1. Adjustable varying speeds, or reversing direction of rotation
2. Syncro-speed, multiple drives used where two or more operations must be coordinated
3. Converters—to supply high frequency current
4. High starting torque with low starting current

Century Wound Rotor Motors are built in sizes up to 400 horsepower and are available in open protected or splash proof frames.

In addition, Century builds a complete line of alternating and direct current motors in a wide range of types and kinds—in sizes from 1/6 to 400 horsepower.

Specify Century motors for all your electric power requirements.



Popular types and standard ratings are generally available from factory and branch office stocks.

Century C MOTORS

**CENTURY ELECTRIC COMPANY** • 1806 Pine Street • St. Louis 3, Missouri

*Offices and Stock Points in Principal Cities*

627

or slightly beneath it so that the final cement finish can be thinly troweled over them. After tightening all screws and connections on boxes, supports and couplings, home runs between junction boxes and distribution centers are installed and the job is ready for final pouring of concrete.

Where larger areas are involved, it is more economical to set up a power saw on the job and cut all duct lengths to exact predetermined measurements before assembling the grids. On these larger jobs it is also expedient to assemble ducts, boxes, supports and home runs prior to final leveling and grouting. In fact, grouting is generally not necessary if pouring is planned immediately after the underfloor duct system has been positioned. The system will be sufficiently rigid to eliminate movement after locking and grounding screws are secured and supports are attached to the base slab.

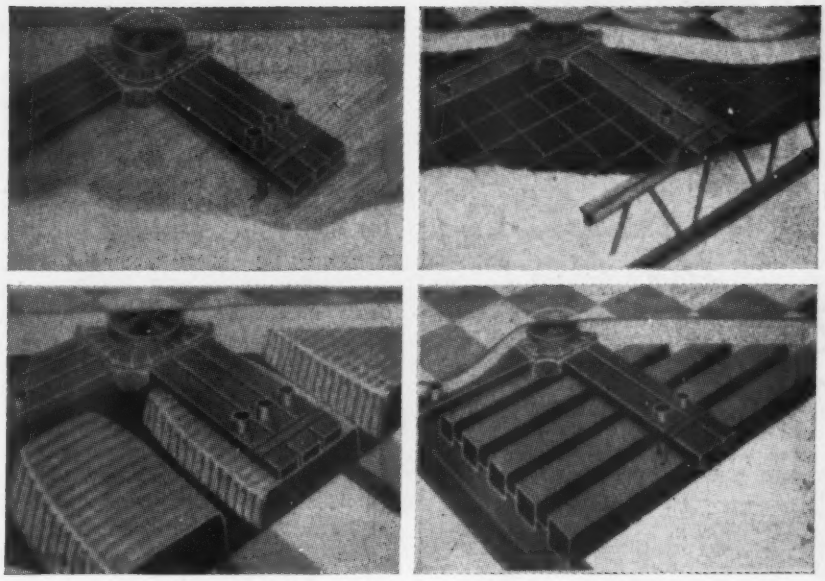
The use of a surveyor's level is of definite assistance in lining up the system prior to pouring operations. And the use of a thin metal cement or asphalt sealing compound is recommended for establishing water-tight connections between ducts, boxes, conduit and fittings.

### Specifications

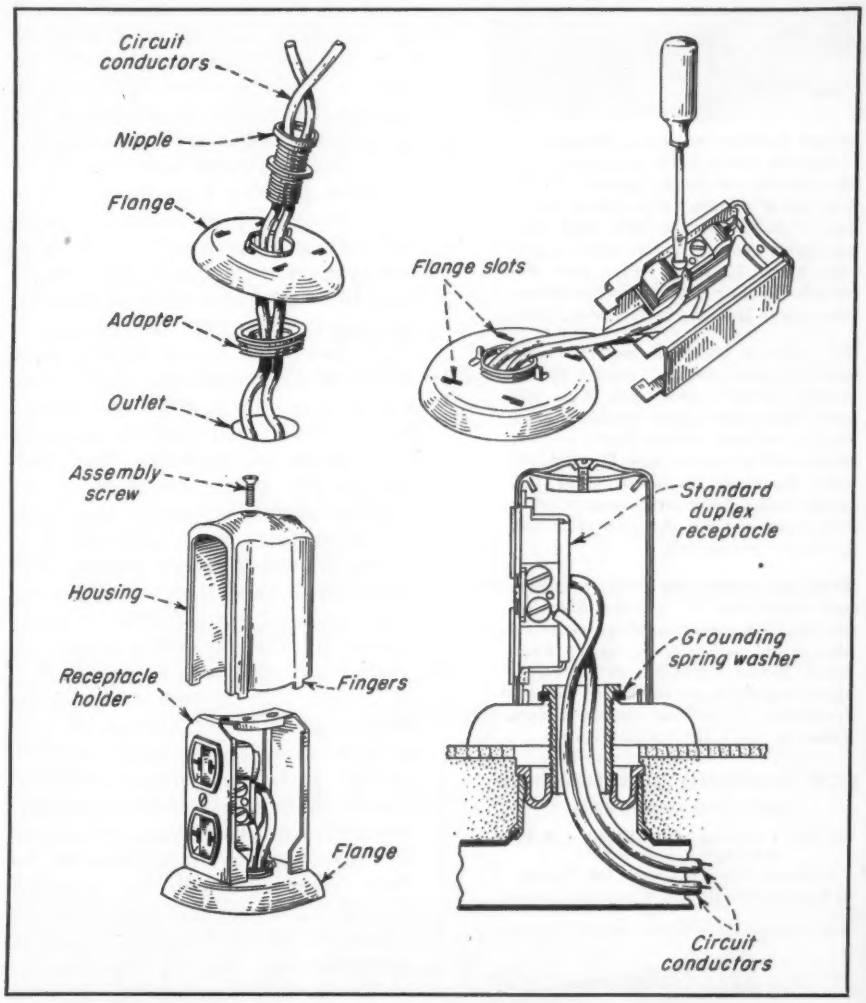
Specifications for an underfloor wiring system should include general provisions and miscellaneous contingencies as well as clauses pertaining directly to ducts, boxes and fittings. The following specifications is a composite of several standard forms prepared by manufacturers of underfloor systems.

"Furnish and install complete metallic underfloor electrical wiring distribution system as shown on the plans and hereinafter specified. The system shall consist of (single, double, triple-duct) runs, as indicated on the drawings, to provide wireways for (110/220-volt service, telephone, low potential signal distribution). All necessary junction boxes, couplings, supports, adapters, conduit feeders and fittings to form a complete installation shall be included.

"The system shall be installed so that outlets will be conveniently located in the floor to provide for all initial and contemplated wiring demands. The system shall be installed in compliance with requirements of the National Electrical Code, article 354, for Underfloor Raceways. All components shall comply with requirements of the Underwriters' Laboratories, insofar as practicable and applicable. All parts fabricated from ferrous materials, with the exception of saddle supports, shall be coated with zinc, cadmium or enamel, as required



***FLOOR CONSTRUCTION** beneath ducts can be either bar joist, metal form, cellular steel, concrete slab or wood, making it feasible to consider underfloor wiring systems for all types of new or existing buildings.*

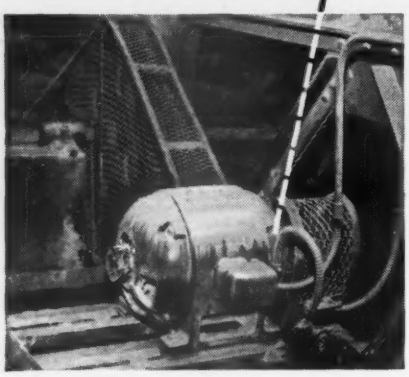



***INSTALLATION** of high potential service fitting begins by slipping adapter, flange, grounding spring washer and nipple over circuit conductors, screwing adapter into duct outlet and tightening the nipple into the adapter. Circuit wires are fastened to receptacle, the receptacle is placed on top of the flange and held in place by an outside housing which is slipped over the receptacle so that bottom fingers engage flange slots. The installation is completed by tightening assembly screw in housing top.*

Silicone News

DC SILICONES

Here's where DC Silicone Insulation Saved $700 per hour



It cost Standard Gypsum Company of California about $700 per hour every time heavy overloads caused the 25 h.p. motor driving screw conveyors in the mixing house to fail. And such expensive motor failures were occurring every 30 to 60 days until the silicone insulated 10 h.p. motor shown above was installed in December, 1948.

This silicone insulated motor is only about ½ the size and weight of the motor formerly used, yet, it is still performing the same work after 8 months without failure. That's what is meant when we say Dow Corning Silicone Electrical Insulation gives you more power per pound, greater reliability, reduced maintenance costs and increased production.

Every day, more and more engineers are specifying DC Silicone Electrical Insulation in motors exposed to excessive heat, moisture, or heavy overloads. If you would like to learn why these engineers are relying on Silicone Insulation, phone our nearest branch office or write for booklet L-10

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

Atlanta • Chicago • Cleveland • Dallas
Los Angeles • New York
In Canada: Fiberglas Canada, Ltd., Toronto
In England: Albright and Wilson, Ltd., London

Photo courtesy Standard Gypsum Company of California

FIRST in Silicones
Dow Corning

by the National Electrical Code rule 3003 (1947).

"Ducts shall be manufactured from number 14 gauge rectangular steel tubing, measuring X-inches by Y-inches and having rounded corners to reduce the tendency of concrete cracking. Duct shall be smooth, straight and delivered to the job site in ten-foot lengths except where otherwise specified. Sufficient couplings shall be supplied to complete the field fabrication of the system, and couplings shall be 3 inches long, constructed from the same gauge metal as the ducts they connect, and equipped with hardened-point grounding screws for establishing a positive, continuous ground throughout the system. Each length of duct shall be provided with five outlets or inserts for establishing floor connections. Outlets, uniformly spaced on 24-inch centers, shall be one-piece 14-gauge metal expanded into the duct in such a manner as to form a continuous steel passage from the duct to the surface of the floor. These outlets shall be Z-inch, inside diameter, threaded for positive protective grounding and for adequately supporting service fittings and connections. Outlets shall be sealed at the upper ends with caps to prevent the ingress of moisture to the raceway system. Caps shall be recessed to receive the cement floor mixture.

"Floor junction boxes to accommodate splices and to facilitate fishing and pulling of conductors, shall be of the type to meet the various conditions of layout and shall be so designed that access may be had through a single hand hole. Boxes shall be manufactured from cast aluminum, enameled or grey iron castings, sherardized and enameled, and shall be provided with means for adjusting their position to the proper elevation of the raceway and, subsequently, their tops to the surface of the finished floor. Boxes for multiple duct systems shall have built-in separators to define compartments and cross-unders for interconnecting the respective ducts. All unused duct and conduit openings shall be closed with fittings designed for that purpose. Junction boxes in concrete floors shall be provided with zinc-coated steel tops. Where linoleum, asphalt tile or similar floor covering is required, spun copper pans with depths corresponding to the thickness of the floor covering shall be provided. Where marble or terrazzo floors are indicated, special brass tops shall be provided.

"Ducts shall be supported, at intervals not exceeding five feet, with adjustable saddle supports to anchor ducts in place and to maintain proper elevation and alignment. Duct ends shall be capped with fittings designed for that purpose.

"All ducts shall be accurately aligned and leveled with the insert tops as near the finished floor surface as practicable, consistent with construction conditions. In concrete floors, outlets shall fall approximately ½-inch below the finished concrete surface, regardless of the probable subsequent application for floor covering.

"Outlets, adjacent to junction boxes, at ends of duct runs, and on each side of building partitions, shall be provided with marker screws clearly visible on the finished floor, from which other outlets may be located by measurement. (In the event that it is intended to include insert locators in the contract, marker screws may be eliminated). For the purpose of accurately locating outlets, the uniform spacing of 24 inches shall be maintained. Where linoleum, asphalt tile or similar floor covering is to be used, marker escutcheons shall be used to prevent the heads of marker screws working through the floor covering.

"After assembly of the system is complete, but prior to pouring of concrete, all joints shall be thoroughly swabbed with sealing compound to prevent infiltration of moisture and concrete.

"Service fittings, for extending wiring connections above the floor, shall be of sturdy construction, cast or formed brass, finished in brushed brass. (In cases where buildings employ aluminum or stainless steel hardware, service fittings of aluminum are available; construction being identical to fittings of brass.) Fittings shall have large floor flanges and screw-thread connections to duct outlets, so that normal abuse will not weaken or break the connection. Service fittings shall include ..... for low potential and ..... for high potential.

"This floor distribution system shall be constructed by the ..... Company, or shall be equal to it in quality and workmanship."

| Size of Conductor | Wire Types and Cross Sectional Area in Square Inches R, RH, RW | T, TW, RU | Number of Wires Allowed by Code R, RH, RW | TW, RU |
|---|---|---|---|---|
| 14 | .0230 | .0135 | 55 | 95 |
| 14 RW | .0327 | ..... | 39 | ..... |
| 12 | .0278 | .0172 | 46 | 74 |
| 12 RW | .0384 | ..... | 33 | ..... |
| 10 | .0460 | .0224 | 27 | 57 |
| 8 | .0760 | .0408 | 16 | 31 |
| 6 | .1238 | .0819 | 10 | 15 |
| 4 | .1605 | .1087 | 7 | 11 |

***LIBERAL WIRING CAPACITY** is indicated by the above table, prepared for ducts having cross sections of 3.22 square inches and used to carry lighting and receptacle circuits. (Prepared in accordance with 1947 NEC.).*

**LOOK FOR THIS NAME**

It identifies aluminum reflectors made extra bright that won't chip, spall, or peel. Clean them regularly and they will last indefinitely. Leading manufacturers make Alzak reflectors in standard shapes and sizes, in specular and diffuse finish.

Over five foot-candles flood Falls Street in Niagara Falls, New York. That's a brilliance 200 times average moonlight. General Electric luminaires with Alzak reflectors make this street one of the world's brightest. Yet there's a note of economy here. Alzak reflectors are efficient . . . have long life . . . save lighting dollars.

Think of your lighting. Big money goes into wire, fixtures and current. Why waste that investment with poor reflectors, when Alzak reflectors give high lighting efficiency. ALUMINUM COMPANY OF AMERICA, 1946K Gulf Building, Pittsburgh 19, Pennsylvania.

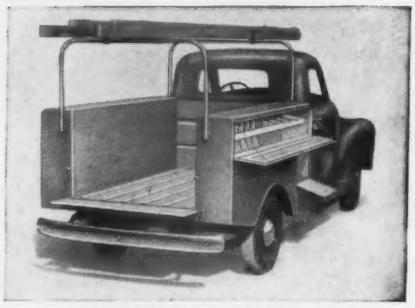
# ALZAK REFLECTORS
## OF ALCOA ALUMINUM

ALCOA ALUMINUM

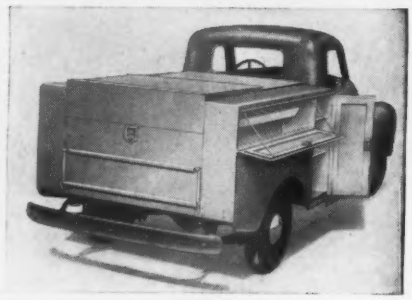
*made by Leading Lighting manufacturers*

# ARTISAN
## TOP QUALITY
## SERVICE BODIES

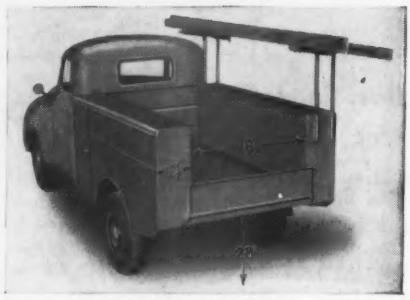
***Prices start at UNDER $300.00***



**MODEL "60"**



**MODEL "75"**



**MODEL "90"**

*MAIL COUPON NOW*
*for complete details*

NAME_____

ADDRESS _____

CITY_____ STATE_____

I am interested in a service body for the following chassis:

☐ ½ TON ☐ 1 TON
☐ ¾ TON

## ELECTRICITY HATCHES CHICKS

[FROM PAGE 55]

outside walls, and waterproof plywood inside walls, thoroughly insulated, they are equipped with a forced air draft heating and cooling system, with full provisions for controlling electrically the temperature and humidity, and automatically turning the egg trays with gentle, even motion to insure even heating during the incubation period.

Each incubator contains six 16-inch high velocity, totally enclosed dustproof fans located in the ceiling along the center corridor within the incubator, and recessed lighting units. The fans force the temperature, and humidity-controlled air down to the bottom of the incubator corridor where it enters the egg tray racks and is then diffused over all the eggs evenly, escaping back upward through the tray racks into the air conditioning ducts overhead. Two 2,200-watt totally enclosed finned tubular electric strip heaters are located in the air conditioning ducts to supply heat, while cold water spray is used to regulate the humidity and for cooling. A gear slide damper controls the quantity of fresh air that enters the incubator, through a front grill provided for that purpose.

Except for the hand-operated master switch, all controls are automatic. They are housed in a fully enclosed control panel located on the outside front wall of the incubator cabinet, and consist of dual temperature controls, recording thermometer, switchgear and circuit breakers.

An artesian well located in the plant supplies water for the plant's water system. The water is pumped into the storage tank by a 15 hp. jet turbine pump. The water is then treated with purifiers and water softeners. An automatic pressure switch controls the motor for this water pump.

A sound system is also installed in the plant, with the broadcast control unit located in the main office. It permits announcements to be made to all employees at any time during working hours, also the playing of music from records, or the rebroadcast within the plant of any radio program. Record music is normally played continuously during working hours.

Harold M. Morris, owner and manager, cooperated in the design of this electrical system with the Miller Electric Company of Salisbury, Maryland, electrical contractors who did the electrical construction and installation work.

## LIGHTING JOB MEETS IES RECOMMENDATIONS

[FROM PAGE 53]

of not more than 50 to 1 as recommended by the National Council on Schoolhouse Construction.

Also, the brightness difference in the peripheral field between the brightest and darkest surfaces was 24 to 1 in Classroom 101, as compared with a difference not to exceed 250 to 1, as recommended by the Council.

This appraisal of classroom lighting in the Mansfield, Ohio school, conducted by an independent consultant, shows (1) that the new standards for school lighting sponsored by the illuminating Engineering Society and the American Institute of Architects, can be easily met with equipment now in production and readily available from school suppliers cognizant of the problem involved, and (2) that rooms so equipped still meet the standards seven months after installation with normal or less than normal maintenance.

The Buckman Electrical Construction Co. of Mansfield installed this lighting system when the schoolroom was remodeled.

**TABLE II.**
**BRIGHTNESS RATIOS**

| Ratio | Classroom 101 | Recommendations | |
|---|---|---|---|
| | | American Standard Practice | National Council |
| A | 1 to 1/1.6 | 1 to 1/3 | 1 to 1/5 |
| B | 1 to 1/9 | 1 to 1/10 | 1 to 1/5 |
| C | 1 to 2.78 (max.) | 1 to 10 | 1 to 10 |
| D | 3.4 to 1 (max) | 20 to 1 | ——* |

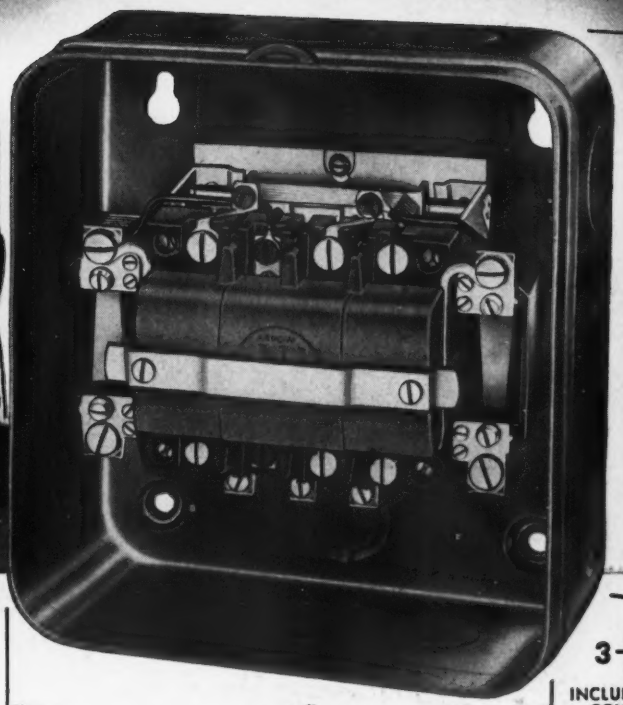
A — Ratio of the central visual field (seeing task) to immediately adjacent surfaces in the surrounding visual field (Brightness of paper to brightness of desk top)
B — Ratio of the central visual field (seeing task) to the more remote darker surfaces in the surrounding visual field (Brightness of paper to brightness of floor)
C — Ratio of central visual field (seeing task) to the more remote brighter surfaces in the surrounding visual field (Brightness of paper to brightness of ceiling)
D — Ratio of brightness of luminaires to surfaces adjacent to them in the visual fields.
* No recommendation.

**TABLE III.**
**LIGHTING LEVEL**

| | Footcandles |
|---|---|
| Classroom 101 | 38 min.<br>69 average* |
| American Standard Practice | 30 min. |
| National Council | 20 min. |

* Some daylight included—dark, cloudy day.

# EASY *to Wire to Service*




SIZE 1 ILLUSTRATED

ARROW AH HART

## NEW "RA" SIZE 1 MAGNETIC STARTER

### THE SMALLEST STARTER ON THE MARKET

***AVAILABLE IN LOCAL AND REMOTE CONTROL OR SELECTOR SWITCH TYPES***

Working electricians — installation and maintenance men — have approved the new Arrow-Hart "RA" Magnetic Starter. Its new design makes wiring easier — straight through all the way — provides roomier wiring space in smaller enclosures and requires less mounting space when installed on panels.

Servicing is easy, too. All terminals and contacts are reached quickly with no waste time or motion. And it is *easier* to install in *smaller* spaces without sacrifice of accessibility or convenience. There's a lot of performance packed into the small and compact enclosure — 6-3/16" x 6-11/16" x 3-5/8". Because of its space-saving features, it outdistances conventional starters in design and performance.

Put these features together and you have the new Arrow-Hart "RA" 1 Magnetic Starter. You get quick, easy hook-ups, long unit life and low maintenance cost. You get a starter that's compact, sturdy and dependable mechanically and electrically — one you can rely on for outstanding performance.

**NEW TYPE "RA" AVAILABLE IN SIZES 0, 1, 2 AND 3**

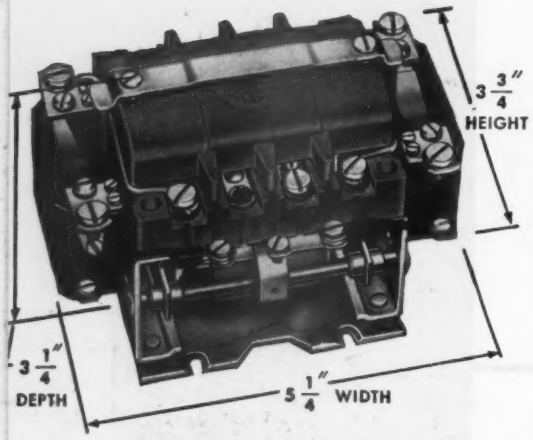
ONTROLS and APPARATUS FOR *Outstanding* PERFORMANCE

ARROW AH HART

# ARROW-HART

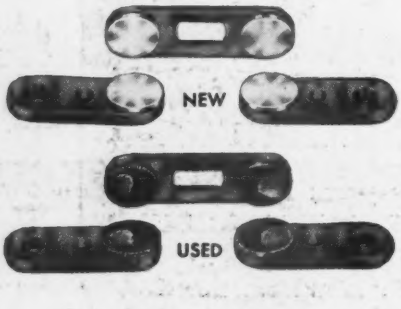
THE ARROW-HART & HEGEMAN ELECTRIC COMPANY
103 HAWTHORN ST., HARTFORD 6, CONN., U. S. A.

# ARROW-HART NEW "RA" MAGNETIC STARTERS ARE EASY TO WIRE - - EASY TO SERVICE




## *Here's Why*

Simplicity of design speeds up installation and maintenance time; saves you money by shortening shutdowns. Be convinced. Loosen one screw — the enclosure cover lifts off and is free of dangling wires. Terminals are all top exposed for direct wiring. Contact inspection or replacement is made readily by loosening two hood retaining screws. Switch can be quickly removed from enclosure by loosening three mounting screws.



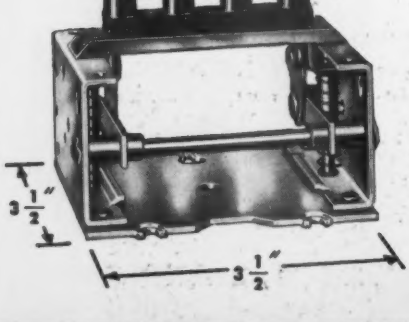

## BIG, TOUGH CONTACTS

Here are rugged, heavy duty, copper contacts with special silver alloy tips that will take plenty of punishment. Special hidden spring-loaded keys provide speedy and easy change of contacts. Simply lift contact to clear guide post — permitting 90° turn of key to free contact. Replace contact and spin key into locking slot. No loose parts.

***Contact surfaces after several hundred thousand cycles at 50 Ampere, 440 Volt, 50% power factor on motor load.***

## PLASKON ALKYD PROTECTION

New thermosetting molding compound used in A-H base and hood features phenomenally high resistance to tracking. ASTM standard test procedure proves that Plaskon Alkyd exceeds the arc resistance of the next best material by 50% to 65%. Does not support combustion. Provides hard and durable surface and superior dimensional stability. The introduction of Plaskon Alkyd is another step to insure maximum performance and long life in Arrow-Hart "RA" Magnetic Starters.




## HERE'S BALANCED MECHANISM

Right angle balanced mechanism multiplies the leverage and transfers it from a vertical to a horizontal plane. Correct contact pressure is assured at all times with reduced wattage consumption of the magnet coil.

***Arrow-Hart Magnetic Starters are available in sizes 0, 1, 2 and 3, to handle motors up to 50 H. P. at 440 and 550 Volt. Write for folder giving wiring diagrams, catalog data and other information.***

*Buy with Confidence*
*Profit by Performance*

ARROW AH HART

# Modern Lighting

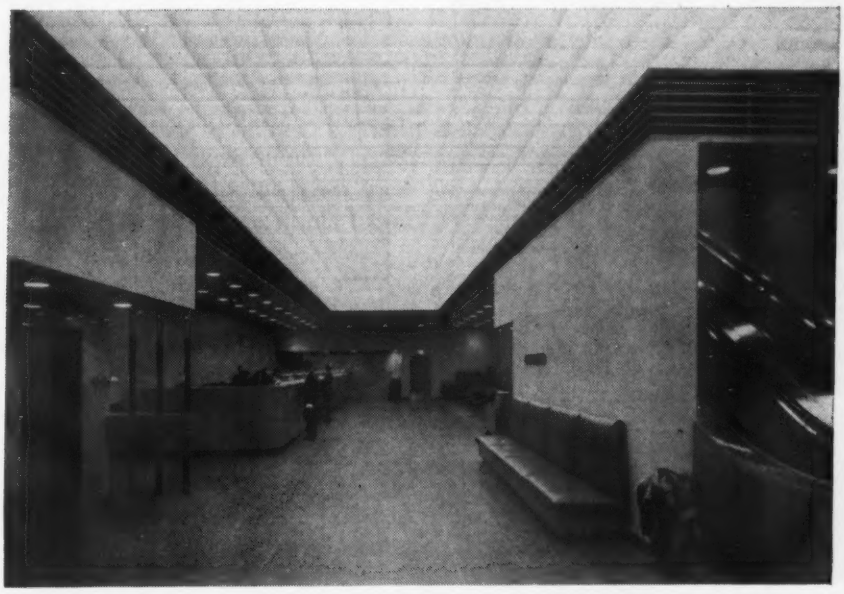
## Bank Lighting Promotes Comment and Confidence

Modern progressiveness is emphasized both by the lighting and by the architectural design of the Central National Bank of Cleveland's recently-completed building on Euclid Avenue, Cleveland, Ohio. These designs promote both comment and confidence, for they reflect judicial comparison of equipment, sound selection, exacting supervision and a high order of workmanship. Comfort and service are obtained by air conditioning, elevators and a moving stairway between the first two floors of this five-story, red Swedish granite and stainless steel structure. And, to provide illumination levels averaging 50 footcandles or above, two distinct treatments are utilized as the basis for the lighting plan.

Of these two treatments, the one designed to provide general illumination utilizes fluorescent light sources, with a louverall ceiling measuring 16¼-by-96 feet suspended over the main floor, and a similar 19½-by-108 foot ceiling illuminating the second floor. Individual cells in these ceilings measure 13-by-13-by-9 inches, construction being brushed aluminum to minimize specular reflection of lamps and to promote even diffusion. Assembled louvered sections, manufactured by the Frink Corporation, are suspended with 14-inch clearances between lamps and louver tops and can be removed easily to facilitate cleaning, relamping and general maintenance. Warm tint fluorescent lamps are supported by ceiling-mounted channels on 2-foot centers and, to obtain continuous rows from border to border of the louverall areas, standard 40-watt lamps are augmented by lamps of the 20- and 30-watt sizes. In the two ceilings, fluorescent lamps total over 1700 feet in length and, with ballasts, represent a connected load of over 20-kw., or 5.5 watts per sq. ft.

The second main lighting treatment consists of 150-watt incandescent downlights recessed into the dropped-ceiling areas bordering central louverall sections, over tellers' cages and over side desk areas. Concentric-ring louvers provide shielding for normal vision angles, directing light downward to working surfaces. Lamps are generally spaced at either 3½- or 6-feet and, where two rows of lamps are installed in parallel, units are staggered for greater uniformity of distribution and for architectural attractiveness. On the two floors, a total of 121 lamps are so installed.

Lighting for areas other than those mentioned varies in treatment and intensity in accordance with functional or esthetic requirements. Therefore, escalators are lighted by eight 150-watt recessed downlights and by 42 channel-mounted 15-watt fluorescent lamps in two rows, with adjacent lamps parallel to each other



***Modern lighting and architectural design includes brushed-aluminum louverall ceilings, recessed downlights in dropped-ceiling borders, fluorescent troffers over check desks, end-lighted glass signs on tellers' counters and special illumination treatments over moving stairway and elevators.***

***Average of 50 footcandles is achieved in desk areas where patterned green carpeting, light green walls, blond woodwork, colorful upholstery and window drapes creates comfortable setting for discussion of customers' banking and investment problems.***

GET LONGER SERVICE
GET RELIABLE SERVICE

# PICK Levolier SWITCHES by McGILL

## for small space installations

Switch space is often limited in modern, streamlined lighting canopies and fixtures, and FHP motor housings. However, by picking a Levolier Model 41 or 71, these units can have a reliable switch that will outperform and outlast most small switches two-to-one.

Model 41—6 amp. 125V. 3 amp. 250V. "T" Rated. ⅝" x 1⅜"

**COMPACT, STURDY MODEL 41** has a single pole, double break mechanism, lever operated for positive control from any angle. It is widely adaptable for conduit box and canopy mounting for either incandescent or fluorescent lighting or FHP motors. Equipped with 6' cord with bell or plain lever. Standard finishes: brass, dark bronze or burnished nickel. Other finishes on special order.

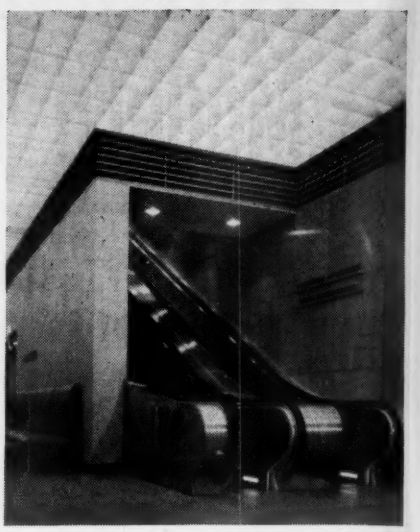
**ONLY McGILL MAKES Levolier SWITCHES**

Push or pull in any direction . . . they work . . . giving economical, current saving individual control. The name Levolier on a switch is your guarantee of quality. Each of the twenty or more parts is made to precise standards and carefully assembled under rigid inspection. Choose Levolier switches for years of trouble free performance, as leading craftsmen and manufacturers have done for over thirty years.

**MODEL 71** for installation where extra-thin switch is essential . . . 15/32" thick! (6 amp. 125V. "T" rated; 3 amp. 250V.) Easily installed with 6" wire leads which are permanently fastened to the terminals by pressure connections. Case is of molded phenolic plastic, with brass, dark bronze or burnished nickel lever. Complete with 6' cord and bell.

*For the New McGill Catalog No. 49 write to McGill Manufacturing Co. Inc., Electrical Division, 450 N. Campbell Street, Valparaiso, Indiana.*

**AVAILABLE FROM YOUR ELECTRICAL WHOLESALER**



***Downlights over landings, threshold lamps at terminals and series of 15-watt channel-mounted fluorescent lamps on 1-foot centers in twin parallel ceiling patterns insure seeing and safety of customers using moving stairway between first two floors of this five-story bank structure.***

on 1-foot centers. Safety deposit vaults are illuminated by eight recessed 150-watt downlights with concentric-louvres, while individual examining booths are lighted by 2-lamp troffers containing 30-watt warm tint fluorescent lamps. Above check desks, wall-mounted 2-lamp troffers are positioned. And tellers' counters are equipped with end-lighted glass signs containing 6-watt fluorescent lamps.

After two months of service, light meter readings measured approximately 50 footcandles throughout the general circulation areas, 40 footcandles on counters and 60 footcandles on check desks.

Throughout the areas discussed, ceilings are acoustically tiled, floors are gray terrazzo, walls are painted light green, woodwork is blond, and upholstery in brown and red leather. In desk areas, patterned green carpeting has been installed and window drapes combine greens and browns with eggshell and white backgrounds. Windows are of special glass designed to reduce glare and to achieve greater insulation against cold and heat.

This entire installation was designed by architects Conrad, Hays, Simpson and Ruth. Louver equipment was manufactured by the Frink Corporation, lamps and accessories being supplied by the General Electric Company. All lighting equipment was installed by the Martien Electric Company of Cleveland. The installation was completed under the personal supervision of Joseph R. Behan, manager of Central National's Building Department.

Customer comments have been consistently complimentary, indicating public favor for this progressive treatment.

# NOW the beautiful new GIBSON Highlander

Here it is—the all-purpose lighting fixture you've been wanting! An overall efficiency of nearly 80% . . . and smooth modern lines . . . give the new Highlander the widest possible range of applications—public buildings, stores, schools, offices. And its VERY LOW COST meets nearly any budget requirement.

PRECISION CONSTRUCTED . . . each fixture is wired with E.T.L. approved brick type ballasts and components to insure a QUIET fixture that will give you maximum lamp life and efficiency.

Each part is precision stamped from 20-gauge cold rolled steel or heavier to provide the sturdiest possible construction. All metal parts are thoroughly processed, and evenly baked in conveyorized oven to insure a uniform quality high-baked enamel finish.

***The Highlander incorporates the same HIGH QUALITY, ENGINEERING FEATURES and WORKMANSHIP that has always been associated with Gibson fixtures.***

Will Also be Available in the New 425 Milliampere, 48 inch.

Gibson MANUFACTURING CO. ATLANTA, GA.

***The South's Finest***

EASY TO INSTALL AND SERVICE . . . like all Gibson fixtures, the Highlander is easy to install. The same #100 continuous single stem set and #200 Dual Stem Set are adaptable to the new Highlander.

The fixture is quickly accessible for cleaning, relamping and maintenance. Pressure on a latch drops the louver assembly and opens the wiring channel for relamping and service. Where desired, the entire louver assembly can be removed by simply lifting the louver from the carrier straps.

We unhesitatingly urge you to compare: 1. Beauty 2. Efficiency 3. Installation 4. Maintenance and service features 5. Quality of materials and 6. Workmanship of the Highlander with that of any other fixture regardless of price. We believe you will agree that the Highlander is the greatest value on the market today.

FOR FULL DETAILS
*Mail Coupon Today*

**SEND COUPON NOW!**

EC&M-2

**Gibson Manufacturing Co.**
**1919 Piedmont Circle, N. E., Atlanta, Ga.**

Gentlemen: Please send me FULL DETAILS and PRICES on the new Gibson "HIGHLANDER".

COMPANY NAME_____

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AUSTIN
"DRIVE-IN"
CABLE STAPLES

No spreading or buckling with Austin staples! Made of heavy, selected temper, round edge flat wire with sharp, burr-free points.

Flat across top — no spreading or buckling.

The shoulders are square and strong—drives easily and accurately.

Long taper to point — staple held firmly at the first tap of hammer.

1⅜"

No. 360
Made for armored cable. Available without indenture in top for non-metallic sheathed cable —Cat. No. 361.

No. 362
Designed specifically for non-metallic sheathed cable. Made shorter for easier driving.

Stamped of heavy, selected temper, round edge flat wire.

Sharp, burr-free points—staple starts easily in any wood.

1⅛"

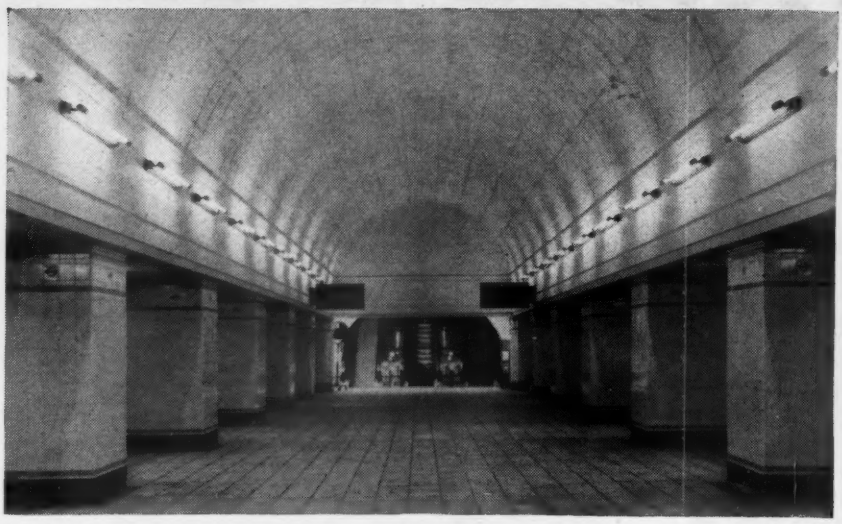
No. 363
The new staple is specially designed for small diameter non-metallic sheathed cable. Small in size — easier to drive.

15/16"

Austin staples are conveniently packed in sturdily made, metal edge cartons of 100 and 500, and in cases of 2500.

The M. B. Austin Company
NORTHBROOK, ILLINOIS

3185



***Daylight fluorescent lamps in special design fittings create comfortable atmosphere and permit comfortable vision in Gants Hill Station, Central Line of London's underground railway.***

## Fluorescents Light London Stations

One of the outstanding features of London's modern stations along the new extension to the Central Line underground railway is the daylight quality illumination provided by fluorescent daylight lamps. These lamps are installed in fittings specially designed to the specification of the London Transport Executive, and supplied by the British Thompson-Houston Co., Ltd. They have been installed in the Bethnal Green, Gants Hill, Wanstead and Redbridge Stations.

The entrance to Gants Hill Station (see photo) takes the form of an adequately yet not excessively illuminated subway, the lighting being sufficiently "warm" in color to create a comfortable atmosphere, and of an intensity which permits comfortable vision. Emergency tungsten lamps provide a comparison between the old and new forms of lighting.

The fittings used have been designed with due consideration of maintenance problems such as the need for lamp replacement, and are of a pattern based on the original design used in the first installation of this kind, made at Piccadilly Circus Station. The auxiliary gear (ballasts) for each lamp is accommodated in shallow metal troughs, at each end of which a bracket arm carries a spring-loaded lampholder. To replace a defective lamp one end is pushed into a holder and the free end is allowed to slide into the opposite holder.

Two independent power supplies are used as a precaution against breakdown. One is 33⅓ cycles and the other is 50 cycles. The spacing of the 80 watt daylight lamps is such that even light distribution results, free from harsh shadows and glare. Fittings blend with architectural design.

**SHALLOW TROFFERS** ***in combination with incandescent downlights are recessed and laid out in patterns to follow the architectural contours of the ceiling, in the Fresh Meadows branch of the Jamaica Savings Bank, Flushing, N. Y. Intensity is 35 footcandles average. The lighting equipment, furnished by Frink Corporation, is both functional and decorative. Troffers use hinged glass shielding, and downlights use prismatic glass lenses.***

# will the Public Revolt *against* FLUORESCENT LIGHTING?

## Will Sub-Standard Quality and Sub-Standard Performance Bring Fluorescent Lighting into Public Disfavor?

SINCE fluorescent lighting equipment was first made available ten years ago, the standards of fluorescent lighting and of fluorescent lighting equipment have been continuously IMPROVED. As a result, fluorescent lighting has quickly achieved national acceptance. This public confidence has been earned by the Lighting Industry because the great majority of the equipment produced and sold to the public has met with the high standards required to provide satisfactory performance.

TODAY the public confidence is being placed in jeopardy by the increasing occurrence of fluorescent industrial units which, instead of being built up to required standards, are being built down to a price.

### How long will it take the public to wake up to unsubstantiated claims?

The public cannot be expected to understand all of the technical factors which differentiate a sub-standard unit from a unit built to deliver sustained trouble-free economical performance.

Informed electrical and lighting men know the importance of high quality starters and lampholders, in terms of easy maintenance, reliable starting and reliable operation.

They know that poor electrical and mechanical design can cause high temperature operations of the ballast resulting in decreased ballast life. They know, also, that lamp life is shortened by a ballast which supplies low starting current or by one that delivers low operating watts to the lamp. They know that low power factor ballasts do not permit efficient utilization of present wiring. They know that well designed and well constructed lighting units, such as those made to RLM Standards, will stand up and give full satisfaction to the customer.

### The Remedy

It is up to the entire Lighting Industry to put this knowledge to work for the benefit of the public. This can best be done by first furnishing customers with the facts about initial cost, maintenance cost and performance of fluorescent lighting equipment and by supplying equipment which is warranted by the manufacturer and certified by an independent testing agency as meeting recognized and published standards of design, construction and performance.

*This Advertisement is published in the Interest of the Entire Fluorescent Lighting Industry by*

RLM STANDARDS INSTITUTE
INCORPORATED

The letters RLM stand for Reflector and Lighting Equipment Manufacturers

326 WEST MADISON STREET • SUITE 821
CHICAGO 6, ILLINOIS

R-3365

# THE SYLVANIA HFFS-296

**This is the fixture your industrial customers have been waiting for—the industrial fixture that makes the most of the outstanding advantages of the new 8-foot, 75-watt, instant-start Slimline Fluorescent Lamps. ¶ The Sylvania HFFS-296 uses an 8-foot channel-like chassis equipped with two 4-foot reflectors for ease of maintenance and installation, and two 75-watt T-12 single-pin lamps. These lamps deliver *more* lumens per foot than previous Slimline Lamps—yet their surface brightness is 22% lower. In addition, they provide a 20% increase in maintained lumens over the life of the lamp.**

## HERE'S THE FIXTURE

## EASY TO MAINTAIN

Dust-free reflector edges prevent collection of dirt, lint or moisture. Captive latches attaching reflectors to chassis allow removal of reflectors without use of tools. Turret lampholders grip the single-pin lamps firmly and safely. No starters to replace, since lamps are instant-start.

## EASY TO INSTALL

Knockouts located in top and ends allow for rigid conduit suspension, entrance wiring and continuous row wiring . . . permitting complete flexibility in installation. Slide grip hanger grooves running the entire length of the chassis provide for supporting the fixture at any desired point.

## HIGH REFLECTION FACTOR

Reflectors are finished with famous durable, non-discoloring Miracoat which has a minimum reflection factor of 86%. And because the Miracoat finish is so easily cleaned with a solution of a mild detergent and water, it's a cinch to *keep* the reflection factor high!

## UNBROKEN LINES OF LIGHT

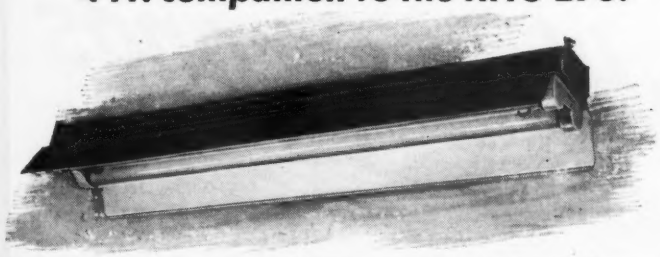
When fixtures are mounted in continuous rows, opening between reflector ends is *only* 1/4 *inch!* Even this small opening can be closed, if desired, by means of Reflector Aligner UA-4001, available as an accessory. Result: unbroken sweeps of light the entire length of the row!

## "Weatherized" of course!

**Like other Sylvania Industrial Fixtures, the HFFS-296 receives a special "weatherizing" treatment to retard rusting, pitting or crazing of finished surfaces—under high-humidity conditions.**

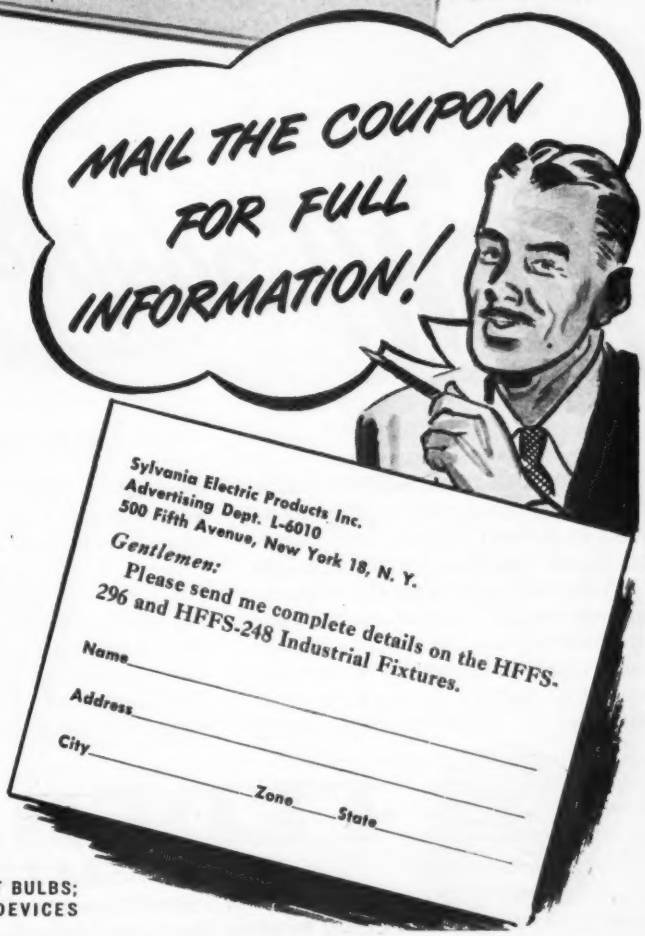
# YOUR INDUSTRIAL CUSTOMERS NEED FOR THE NEW 8-FOOT INSTANT-START LAMPS!

**. . . and here's the HFFS-248**
**4 Ft. companion to the HFFS-296!**



The HFFS-248 is a 4-foot fixture, especially designed to finish out a row of HFFS-296 fixtures where space does not permit use of the longer unit. The HFFS-248 is supplied with one reflector and two 40-watt, single-pin, instant-start lamps.

These two new fixtures mean new business for you—get the facts today!




# SYLVANIA ELECTRIC

FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES, SIGN TUBING; LIGHT BULBS; PHOTOLAMPS; RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES

# NOW!-adaptable in seconds

***New Federal Noark QL Panelette gives you complete, time and money-saving flexibility***

THE REMARKABLE NEW NOARK QL Panelette is adapted to job requirements in seconds by snapping in Federal Noark Quicklag Circuit Breakers of the desired amperages. These Quicklags are rugged, factory-sealed units with fully dependable action . . . quick-make, quick-break insures positive action, longer contact life . . . high speed magnetic trip instantly clears heavy overloads . . . thermal trip holds harmless, momentary current surges yet trips on sustained small overloads.

2-, 4-, 8-, 16-, or 20-breaker capacity Panelettes can quickly be made up in any practical combination of 15, 20, 30, 40 and 50 ampere Quicklag units. Handle extensions give double-pole operation. Covers available for flush or surface mounting. Vacant breaker spaces for future expansion are covered with closure plates. Additional Quicklags are readily available from Federal jobber's stock.

Order Noark QL Panelettes from your Federal Distributor, and install them as the most modern, safe, expandable type of overload protection. Write us for descriptive booklet. Federal Electric Products Company, 50 Paris St., Newark 5, New Jersey.

Federal NOARK

**FEDERAL NOARK**

***QL PANELETTES***

**Complete line of Federal Electric Products includes Motor Controls, Safety Switches, Service Equipment, Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct ★ Sales offices in principal cities.**

# In the News

## 1949 NEC Revisions

The proposed 1949 amendments to the 1947 National Electrical Code were considered by the Electrical Section of N.F.P.A., reviewed by the Electrical Correlating Committee in the light of the discussion in the Electrical Section meeting, and adopted by the annual meeting in the final general session. The 1949 amendments are being incorporated in a new edition of the Code, as follows:

### Article 110—General

*Section 1109. Conductors:*

Change cross reference in last line to section 3106.

*Section 1117. Connections to Terminals:*

Add a fine print note reading:

Because of different characteristics of copper and aluminum the devices and fittings; such as pressure connectors, splices, solder lugs, solders, and fluxes, employed where making connections should be suitable for the material of the conductor.

### Article 200—Polarity Identification of Systems and Circuits.

*Section 2005. Means of Identification of Conductors:*

Add a new sub-paragraph, *"d"*, reading:

d. If, on a 4-wire delta-connected secondary, the mid-point of one phase is grounded to supply lighting and similar loads, that phase conductor having the higher voltage to ground shall be identified by painting or other effective means at any point where a connection is to be made if the neutral conductor is present.

### Article 230—Services

*Overcurrent Protection*

*Section 2371. Where Required:*

Add a fine print note to follow *sub-paragraph 4 of paragraph a* to read:

A set of fuses is all the fuses required to protect all the ungrounded conductors of a circuit.

*Services Exceeding 600 Volts*

*Section 2389. Overcurrent Protection:*

*Paragraph a, sub-paragraph 2,* revise to read:

2. If the voltage is 25,000 or less, a non-automatic switch capable of interrupting the rated circuit load and suitable fuses may be used.

*Paragraph d, Circuit Breakers,* change second sentence to read:

This can be accomplished by means such as trip-free breakers or by multiple breakers having an operating handle per pole. (Omit balance of this sentence of 1947 text.)

*Section 2390. Isolating Switches:*

*Paragraph a,* change first two lines to read:

Air break isolating switches shall be installed between oil switches or air or oil circuit breakers.....etc.

### Article 240—Overcurrent Protection

*Section 2403. Overcurrent Protection of Conductors:*

*Paragraph a, Fuses,* revise the first sentence to read:

If the allowable current-carrying capacity of a conductor does not correspond to the rating of a standard-size fuse, the next larger size or rating of fuse may be used but in no case shall the size or rating of the fuse exceed 150 per cent of the allowable current-carrying capacity of the conductor.

*Section 2409. Grounded Conductor;* Insert a new paragraph *"c"* to read:

c. For motor-running protection as provided in sections 4326 and 4327.

### Article 250—Grounding

*Grounding Electrodes*

*Section 2581. Water Pipe:*

Change to read:

A metallic underground water piping system, either local or supplying a community, shall always be used as the grounding electrode where such a piping system is available. If the buried portion of the metallic piping system is less than ten feet (including well casings bonded to the piping system) or there is some liklihood of the piping system being disconnected, it shall be suplemented by one or more of the grounding electrodes recognized in sections 2582 and 2583.

*Section 2582. Other Available Electrodes:*

*Sub-paragraph c,* change to read:

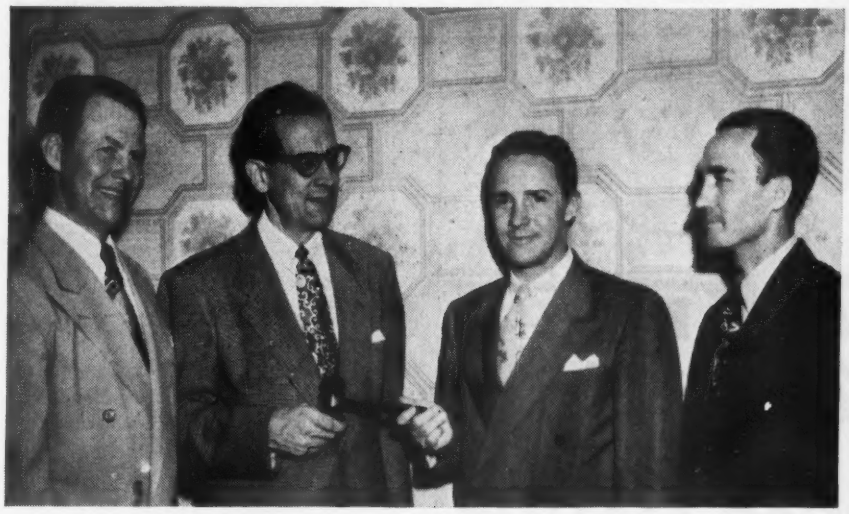
c. Other local metallic underground systems, such as piping, tanks, and the like.

*Section 2583. Made Electrodes:*

*Paragraph b, Pipe electrodes,* change to read:

b. Electrodes of pipe or conduit shall be not smaller than of the ¾-inch trade size and, if of iron or steel, shall have the outer surface galvanized or otherwise metal-coated for corrosion protection.

*Section 2586. Use of Lightning Rods:*



***New chairman of the Chicago Section, I.E.S., Ralph R. Cheney (left center), Westinghouse Lamp Division, Chicago, receives gavel from retiring chairman Glenn G. Boyd of Public Service Co. of Northern Illinois in Joliet. Watching ceremony are new vice-chairman Clarence B. Pederson, (left) Illinois Bell Telephone Co., Chicago; and secretary Robert R. Lusk (right), Commonwealth Edison Co., Chicago.***

**The KNOPP Voltage Tester with the PROD-MOUNT Saves Time, is Reliable!**

**5 Safety Features . . . Many Uses**

Say "Goodbye to risky, time-wasting fuss in testing" with the 5 main safety features in the Knopp Voltage Tester: (1) exclusive Prod-Mounting Socket in housing making this tester easier, faster, and safer to use and ending time-wasting "three-handed" testing; (2) protection through DUAL indication of voltage by solenoid and neon lamp working independently; (3) positive scale reading; (4) signal by hum and vibration; and (5) thorough insulation throughout, even to the sharp point of each prod.

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**ELECTRICAL FACILITIES INC.**

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Change to read:

Lightning rod conductors and driven pipes, rods or other made electrodes used for grounding lightning rods shall not be used in lieu of the made grounding electrodes required by this Article for grounding wiring systems and equipment. The foregoing provision shall not be taken to forbid the bonding together of the several made electrodes that are respectively provided for electric wiring systems and equipment, for communication systems, and for lighting protection. (See section 8041-b-5.)

*Grounding Conductors*

*Section 2594. Alternating-Current and Service Equipment:*

Make separate paragraphs of the present text, as follows:

*a. Wiring System and Common Grounding Conductor.* The size of the grounding conductor for an alternating-current system or for a common grounding conductor shall not be less than is given in the following table, except that where connected to made electrodes (as in section 2583) the conductor need not be larger than No. 6 copper wire or its equivalent in carrying capacity.

| *Size of largest service Conductor or Equivalent for Multiple Conductors* | *Size of Copper Grounding Conductor AWG. No.* |
|---|---|
| 2 or smaller | 8 |
| 1 or 0 | 6 |
| 00 or 000 | 4 |
| Over 000 to 350,000 c.m. | 2 |
| Over 350,000 c.m. to 600,000 c.m. | 0 |
| Over 600,000 c.m. to 1,100,000 c.m. | 00 |
| Over 1,100,000 c.m. | 000 |

*b.* If the wiring system is not grounded at the premises, the size of a grounding conductor for a service raceway, for the metal sheath or armor of a service cable and for service equipment shall be not less than is given in the following table, except that where connected to made electrodes (as in section 2583) the conductor need not be larger than No. 6 copper or its equivalent in carrying capacity.

| Size of Largest Service Conductor or Equivalent for Multiple Conductors | Size of Grounding Conductor Copper Wire AWG. No. | Conduit or Pipe Trade Size (inch) | Electrical Metallic Tubing Trade Size (inch) |
|---|---|---|---|
| 2 or smaller | 8 | ½ | ½ |
| 1 or 0 | 6 | ½ | 1 |
| 00 or 000 | 4 | ¾ | 1-¼ |
| Over 000 to 350,000 c.m. | 2 | ¾ | 1-¼ |
| Over 350,000 c.m. to 600,000 c.m. | 0 | 1 | 2 |
| Over 600,000 c.m. to 1,000,000 c.m. | 00 | 1 | 2 |
| Over 1,100,000 c.m. | 000 | 1 | 2 |

The fine print note following table of present section 2594 is to be omitted.

*Grounding Conductor Connections*

*Section 2612. Grounding Conductor to Electrodes:*

*Paragraph a. To Water Pipe.* Insert the following after the first sentence of the paragraph.

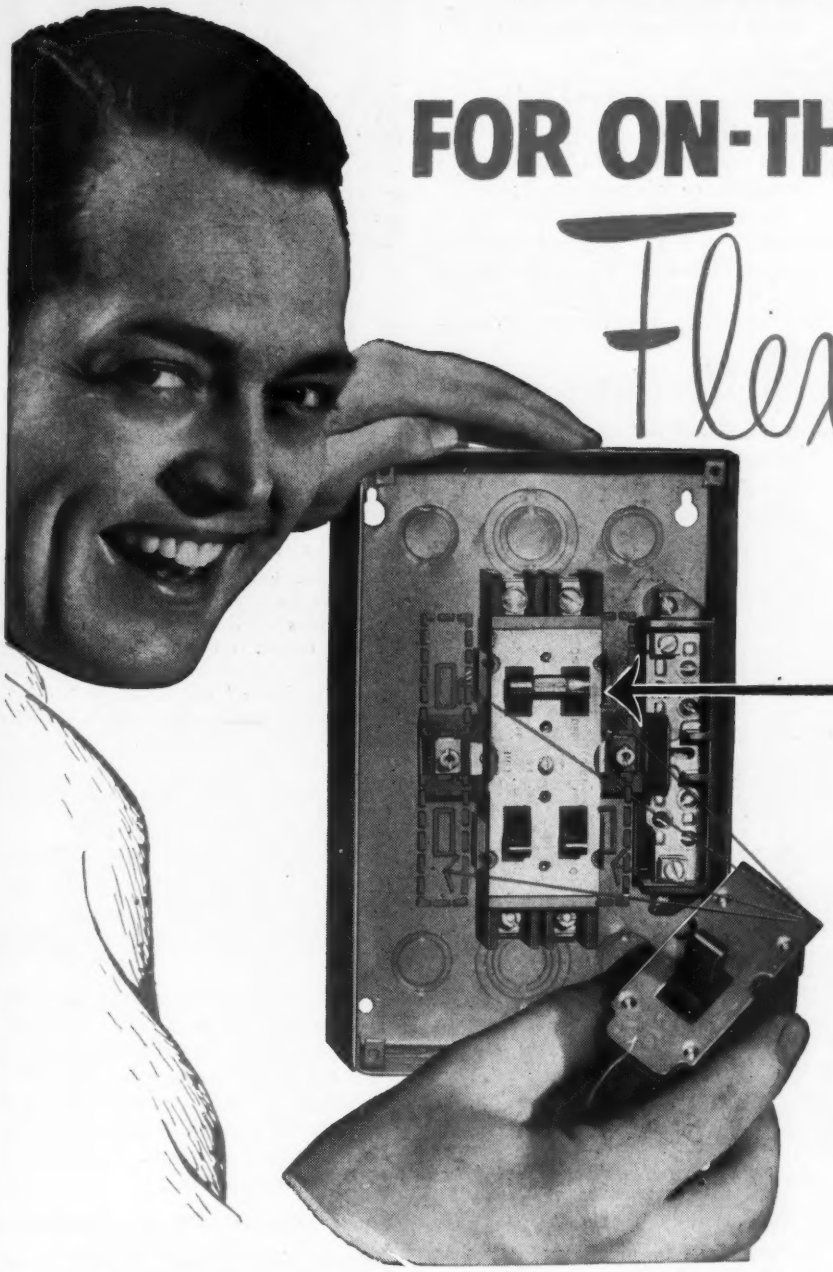
If the source of the water supply is from a driven well in the basement of the premises, the connection shall be made as near as practicable to the well.

**Article 300—Conductors**

*Section 3102. Conductor Insulation: Type AF, Asbestos-Covered Heat Resistant Fixture Wire:* Change values for max. operating temp. (col. 3) of table to 150 C
302 F

***Hillrie Griffith, vice president of the Belyea Company, checks one of eight crates containing transformers and rectifiers for a Shanghi customer, indicating that this Jersey City, N. J., repair organization serves the world. With 35,000 sq. ft. of shop area, a private railroad siding and four heavy-duty traveling cranes with capacities up to 30 ton, Belyea is equipped to handle anything that can be delivered to them by either rail or truck. One of Belyea's recent large jobs was on a 60-rpm, 4,000-hp. motor weighing 180 tons. In this case the rotor measured 10 feet in diameter while the bed plate measured 16-by-17. Such work calls for electrical men with a wide background—and many of Belyea's men have been with the company for more than a quarter of a century—a silent tribute to excellent labor-management relations.***

# The Cutler-Hammer MB-4 Multi-Breaker



## FOR ON-THE-JOB *Flexibility*

***This is the***
**FUNDAMENTAL UNIT**

**The Cutler-Hammer MB-4 Multi-Breaker is fundamentally a standard 4-pole Multi-Breaker in an enclosing case. However, provisions have been made both in construction and space for additional single pole Multi-Breakers.**

*These are the units*
**ADDED ON THE JOB**

**The additional single-pole Multi-Breaker units can be added at any time . . . before, or at the time of installation or later, so as to make up the exact Multi-Breaker required by the job. Each additional unit slips into place and is secured by a screw.**

The Cutler-Hammer Type MB-4 Multi-Breaker marks another big step ahead in modern electrical circuit protection. It is BIG news for contractors; equally BIG news for the wholesalers who supply them.

Now the contractor can make up just the Multi-Breaker he needs for each job. To the fundamental unit he simply adds from one to four add-on units as the number of circuits and their capacities dictate. Further, any of the add-on units can be changed on the job AFTER the complete Multi-Breaker is installed if the circuit requirements change; just a simple change, not a major operation. No delay. No trouble.

With the C-H Type MB-4 Multi-Breaker, the wholesaler can offer maximum service with minimum stocks, minimum investment, minimum inventory. He can furnish *exactly* the Multi-Breaker needed for *each* job without maintaining a large and complex assortment of complete Multi-Breakers incorporating the many combinations of breakers possible.

The Cutler-Hammer MB-4 provides Thermal-Magnetic trip for lag on harmless overloads but *instant* trip on short circuits. *Electronically* calibrated like all Cutler-Hammer Multi-Breakers for dependable performance. 70 ampere mains for small homes. 100 ampere mains for large homes. Breakers from 15 to 50 amperes. Underwriters' approved. Available in flush or surface mounting. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wis.

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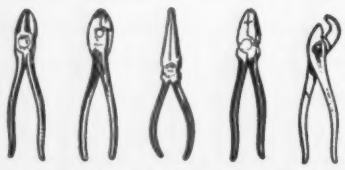

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**Article 320—Open Wiring on Insulators**

*Section 3203. Types of Conductors:*
Add the following sentence:
Only single conductors shall be used.

**Article 334—Armored Cable**

*Section 3342. Use:*
Insert the following to be the fourth sentence of this paragraph:
Armored cable may be run or fished in the air voids of concrete masonry block or tile walls where such walls are not exposed or subject to excessive moisture or dampness.

**Article 338—Service-Entrance Cable**

*Section 3382. Use:*
Delete the word *master* in the sixth-seventh line of the present text.
Note: when this deletion is made it will be in order to consider that the definition of a "master service", see Article 100, is no longer needed in the text of the National Electrical Code.

**Article 346—Rigid Metal Conduit**

*Section 3464. Wet Locations:*
In the sixth line change the dimension one-half inch to one-quarter inch.

**Article 348—Electrical Metallic Tubing**

*Section 3484. Wet Locations:*
In the sixth line change the dimension one-half inch to one-quarter inch.

**Article 354—Underfloor Raceway**

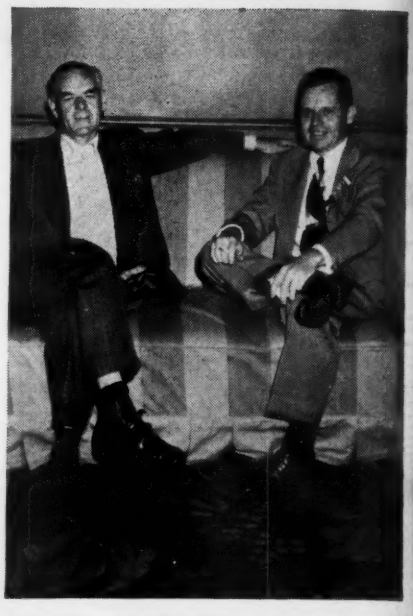
*Section 3542. Use:*
Delete the phrase "for signal and control circuits" in the third line.

*Section 3543. Covering:*
*Paragraph a. Raceways Not Over 4-Inches Wide.* Add to present text:
"and shall be placed not less than one-half inch apart, except that, in office occupancies, metal flat-top raceways not over four inches in width and placed at least one-half inch apart, may be laid flush with a concrete floor surface, if covered with substantial linoleum at least one-eighth inch thick or with an equivalent floor covering.

*Paragraph c. Raceways Flush With Concrete:*
Delete this section.

**Article 362—Wireways**

*Section 3624. Number of Conductors in Raceway:*
Add a fine print note to the present paragraph reading:
The correction factors specified in Note 4 of Table 1 of Chapter 10 are not applicable to the foregoing.



***Electrical Inspector Martin C. O'Rourke, City of Waterbury, Conn. (left) chats with Richard G. Newton, Rockbestos Products Corp., New Haven, Conn. on National Electrical Code problems during the recent Annual Meeting of the Eastern Section, IAEI, held in Boston, Mass. at the Hotel Statler.***

**Article 370—Outlet, Switch and Junction Boxes, and Fittings**

*Section 3704. Metallic Outlet Boxes:*
In line 2 (N.F.P.A. edition only) change word "of" to "or".

*Section 3709. Number of Conductors in a Box:*
Add a fine print note under the table heading "Deep Boxes" to read:
Where there is not sufficient space for a deeper box, four No. 14, AWG conductors may enter a box provided with cable clamps and containing one or more devices on a single mounting strap.

**Article 373—Cabinets and Cutout Boxes**

*Section 3732. Damp or Wet Locations:*
In the fifth and sixth lines change the dimension one-half inch to one-quarter-inch.

**Article 374—Auxiliary Gutters**

*Section 3745. Number of Conductors in Raceway:*
Add a second fine print note to follow this paragraph reading:
The correction factors specified in Note 4 of Table 1 of Chapter 10 are not applicable to the foregoing.

**Article 400—Flexible Cords**

*Section 4005. Show-Windows and Show-Cases:*
Add Types SU and SUO to those now listed in this text. (To be inserted according to alphabetical order.)

# A Lighting Fixture as Big as the Room

# IT'S PLEXIGLAS

PLEXIGLAS *diffusing panels in control room of Philadelphia Electric Company generating station. Large sections of white translucent* PLEXIGLAS, *installed below cold cathode tubes, give excellent glare-free illumination.*

Here's the newest thing in large-area lighting—*pure illumination without glare or shadows*—diffused by large PLEXIGLAS plastic panels, installed wall-to-wall. And here's safety overhead, because PLEXIGLAS is light, strong, shatter-resistant.

Actually, white translucent PLEXIGLAS diffuses light so completely that shadows and glare simply vanish. Minimum absorption and maximum transmission of light give full, even illumination throughout any room. Brightness ratios are remarkably low.

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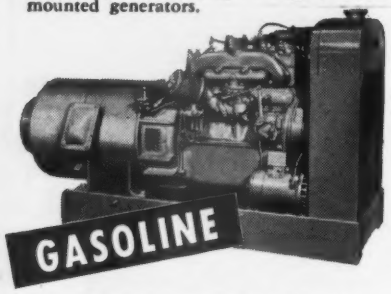
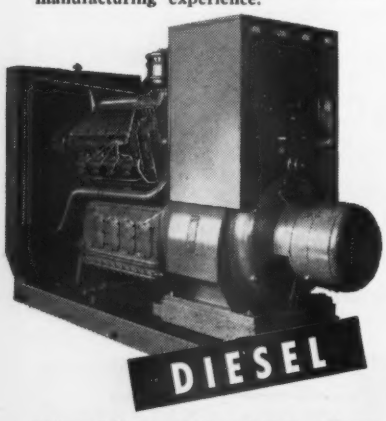



From ½ kw up — A.C. and D.C. You can recommend these units with complete confidence. Their "built-in" dependability is the result of over 40 years manufacturing experience.

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*Section 4007. Insulation—Over 300 Volts:*

Add Types SU and SUO to those now listed in this text. (To be inserted according to alphabetical order.)

**Article 410—Lighting Fixtures, Lampholders, Lamps, Receptacles and Rosettes**

*Wiring of Fixtures*

*Section 4144. Conductor for Special Conditions:*

Add Types RUF and RUFF fixture wire to those with rubber insulation now listed in this section, (Insert after FF-32 in fourteenth line.)

**Article 430—Motors and Controllers**

*Motor Overcurrent Protection*

*Section 4321. General:*

Add a fine print note to follow this paragraph reading:

For fire-pump motors, see NBFU pamphlet No. 20—Standards for the Installation and Operation of Centrifugal Fire Pumps.

*Section 4322. Continuous Duty Motors:*

*Change line 4, sub-paragraph 1 of paragraph a, More Than One Horsepower, to read:*

". . . for motors marked to have a temperature. . ."

*Change line four of sub-paragraph 1, paragraph c, One Horsepower or Less-Automatically Started, to read:*

". . . for motors marked to have a temperature. . ."

*Section 4325. Shunting During Starting Period:*

Change first sentence so that its present first two lines will read:

If the motor is manually started (including starting with a magnetic starter having pushbutton control), the running overcurrent protection. . . . . .

*Section 4326. Fuses—In Which Conductor:*

Add to the present sentence as follows:

, except that a fuse shall also be inserted in a grounded conductor under the circumstances set forth in section 4327 for circuits supplied by wye-delta or delta-wye connected transformers.

*Section 4327. Devices Other Than Fuses—In Which Conductors:*

Insert an asterisk to precede the figure 2, third column for each of the four kinds of 3-phase-motors.

Also add, in rule text, at end of table the following:

*Note: In the case of distribution systems supplying wye-delta or delta-wye connected transformers (having the wye neutral point in the primary ungrounded or not connected to the circuit) the authority enforcing this code may require that three running over-current units be provided for the protection of three-phase 3-wire motors, if field experience in the territory of the authority indicates that a third unit is desirable because of motor winding failures at times of primary single phase failures, unless the motors are otherwise adequately protected.

Present fine print note.

To correct a proof-reading oversight, the fine print text now following Section 4327 (NFPA edition only) is to be transposed so as to follow Section 4328.

*Section 4374. Switching:*

Change the final clause of the first sentence to read:

"except when a separate switch complying with paragraph b of section 4386 is used for the control circuit."

*Motor Controllers*

*Section 4383. Rating:*

*Paragraph c. Portable Motor of . . . . Horsepower or Less:* Change the value of "¼" to "⅓" in both the paragraph caption and in its text.

**Article 450—Transformers and Transformer Vaults**

*Section 4524. Oil-Insulated Transformers Installed Outdoors:*

Substitute the following . . . . paragraphs for the present text.

*Oil-Insulated Transformers Installed Outdoors.* Combustible material, combustible buildings and parts of buildings, fire escapes, door and window openings shall be safeguarded from fires originating in oil-insulated transformers installed on, attached to, or adjacent to a building or combustible material.

Space separations, fire-resistant barriers and enclosures which confine the oil of a ruptured transformer tank are recognized safeguards. One or more of these safeguards shall be applied according to the degree of hazard involved in cases where the transformer installation presents a fire hazard.

Oil enclosures may consist of fire-resistant dikes, curbed areas or basins, or trenches filled with coarse crushed stone. Oil enclosures shall be provided with trapped drains in cases where the exposure and the quantity of oil involved are such that removal of oil is important.

**Article 725—Remote Control, Low-Energy Power and Signal Circuits.**

*Class 1 Systems*

Insert two news sections, numbered 7265 and 7266, to read as follows:

*Section 7265. Number of Conductors in Raceways:*

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A General Electric Affiliate
PROVIDENCE, R. I.

# ALL-IN-ONE SURFACE WIRING UNITS

**Save up to 50%** on Installation Time for Each Outlet Installed . . . Eliminate Separate Boxes, Devices, Covers, Fittings.

★ **Feed through bus in each device—no splicing, no taping, no soldering. Saves time. Saves 6" to 12" of cable at each outlet.**

★ **Knockouts, when broken out, become sturdy approved cable clamps for non-metallic cable and building wire.**

★ **For BX cable, separate metal clamp secures cable and acts as a continuing ground.**

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**Wherever** conventional surface wiring is used in the city or on the farm, you can cut costs and get a permanent workmanlike job with Monowatt Surface Wiring Units. Made of brown plastic, these all-in-one units are light, tough, durable. Entire group meets Federal and REA Specifications and is approved by Underwriters' Laboratories for use with building wire, non-metallic cable or BX. War-tested in all climates throughout the world, these all-in-one units provide an improved and *job-proved* method of permanent wiring.

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**MEET FEDERAL** UL REA **SPECIFICATIONS**

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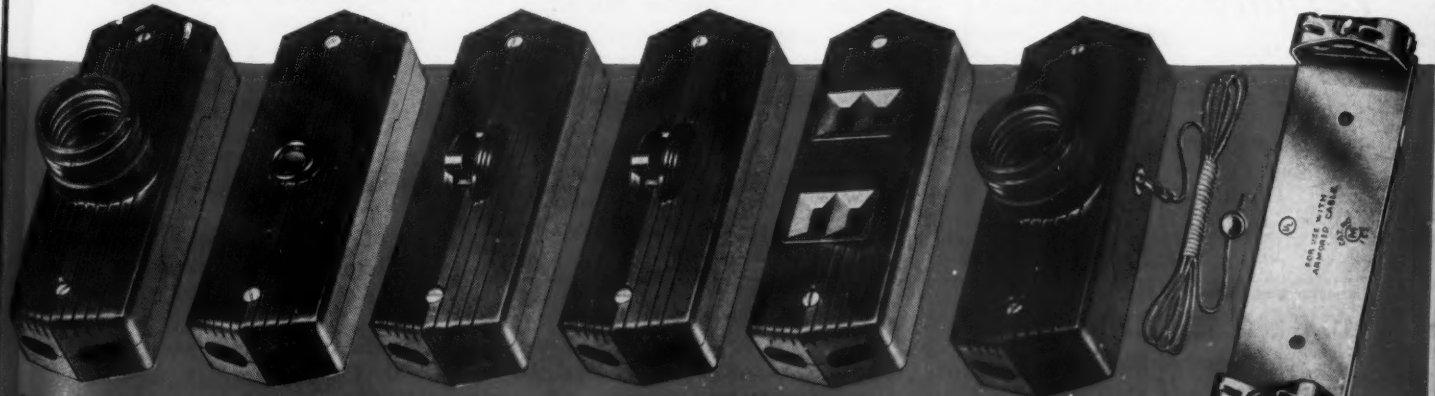


**Cat. No. 2655**—Keyless Lampholder. 660W-250V. Meets Federal Specification W-L-142.

**Cat. No. 2670**—Junction Box or Rosette. Knockout in center converts unit to rosette. 660W-250V. Meets Federal Specification W-S-890. Meets Federal Specification W-R-151a.

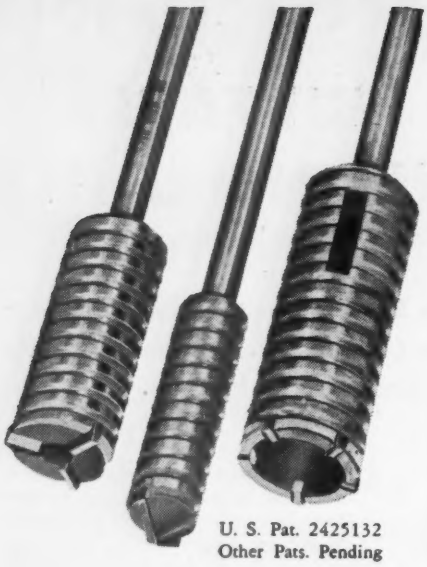
**Cat. No. 2630**—Single Pole Switch. "T" Rated. 5A-250V; 10A-125V. Meets Federal Specification W-S-890.

**Cat. No. 2633**—Three Way Switch. "T" Rated. 5A-250V; 10A-125V. Meets Federal Specification W-S-890.

**Cat. No. 2620**—Double Outlet. Double Wipe Contacts. 10A-250V; 15A-125V. Meets Federal Specification W-R-151a.

**Cat. No. 2651** Pull Chain Lampholder with braided pull cord. 250W-250V. Meets Federal Specification W-L-142.

**Cat. No. 2690**—BX Clamp Attachment.



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- **Eliminates breakage of concrete . . . the *Termite's* smooth, vibrationless action allows you to drill close to the sides and edges of concrete members without fracturing the concrete.**

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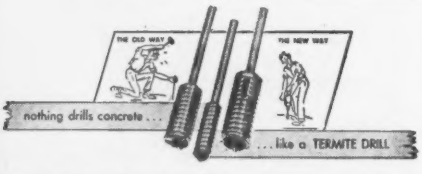


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The number of conductors of remote control or signal circuits in a raceway may be determined according to Tables 4 or 9 of Chapter 10; and Note 4 of Table 1 need not be observed. Where power or lighting circuit conductors are in a raceway with remote-control conductors, the provisions of Note 4 shall not apply to the conductors for remote control. Present cross references in section 3011 to be edited to correspond to this new text.

*Section 7266. Conductors of Different Systems:*

Conductors of two or more Class 1 remote-control and or signal circuits may occupy the same enclosure or raceway without regard to whether the individual systems or circuits are alternating or direct current, provided all conductors are insulated for the maximum voltage of any conductor in the enclosure or raceway. Conductors of remote-control, low-energy power and signal circuits, in which the current is limited as for Class 2 systems, shall be considered as Class 1 system conductors for the purpose of this requirement if insulated and installed in accordance with the provisions for Class 1 system conductors.

*Present Sections 7265 to 7269 inclusive:*

Sections 7265 to 7269 inclusive shall be renumbered 7267 to 7271 respectively.

*Limitation of Class 2 Remote-Control and Signal Systems*

*Section 7281: Limitation of Class 2 Systems:*

*Paragraphs a, b, and c:* Change the term "inherent-current limiting" in the second sentence of each of these three paragraphs to "energy-limiting."

*Section 7283. Transformer Rating:*

*Delete* the final phrase *"and whether or not of the current-limiting type."*

**Article 800—Communication Circuits**

*Section 8001. Scope:*

*Present second fine-print note.* Delete words *"burglar alarm."*

*Outside Conductors*

*Section 8022. Lightning Conductors:*

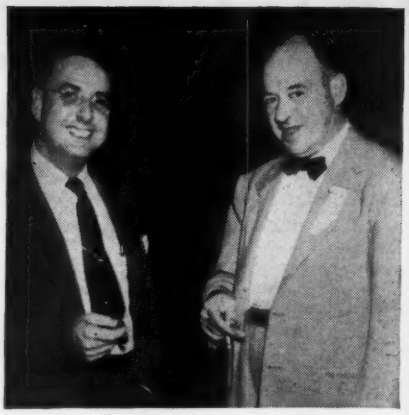
Revise this paragraph so that it will read:

When practicable, a separation of at least six feet shall be maintained between open conductors of communication systems on buildings and lightning conductors.

*Grounding*

*Section 8041. Grounding:*

*Paragraph b. Protector Ground, Sub-paragraph 5:* Change last sentence to read:



***Boston representative Pat Lepore of Bright Light Reflector Co. (left) has a social chat with Jack Leary, President, Electrical Agencies, Inc., Boston, during the recent Annual Meeting of the International Association of Electrical Inspectors held at the Hotel Statler, Boston.***

The requirements for separate made electrodes for power and lighting system grounds, those for communication systems, and those for a lightning rod installation shall not prohibit the bonding together of all such made electrodes. See section 2586.

**Article 810—Radio Equipment**

*Antenna Systems-General*

*Section 8111. Material:*

Insert "aluminum alloy" after the word bronze in the second line.

*Section 8115. Indoor Antenna:*

Delete the present caption and text and substitute as follows:

*Section 8115. Structures.* Metal structures supporting antennas shall be permanently and effectively grounded.

*Antenna Systems-Receiving Station*

*Section 8121. Size of Antenna and Counter-poise:*

Change this caption by inserting *Wire-Strung* to precede the word Antenna.

Identify the present text and table as paragraph *a.*

In the column of the table headed *Material,* insert "aluminum alloy" to precede hard-drawn copper in the first bracket, or line.

Add a new paragraph to read:

*b. Self-Supporting Antennas.* Outdoor antennas, such as vertical rods or dipole structures, shall be of noncorrodible materials and of strength suitable to withstand ice and wind loading conditions.

*Section 8123. On Buildings:*

Substitute the word "clearances" for the present caption of the section.

Make the present text paragraph *a* with the caption *On Buildings Outside.*

Add to the last sentence of the present text.

"unless the bonding referred to in section 2586 is accomplished."

Add a new paragraph *b* to the section with caption *Antennas and Lead-Ins-Indoors* and with text as follows:

*b. Antennas and Lead-Ins-Indoors.* Indoor antennas and indoor lead-ins shall not be run nearer than two inches to conductors of other wiring systems in the premises unless

(1) such other conductors are in metal raceways or cable armor, or

(2) unless permanently separated from such other conductors by a continuous and firmly fixed nonconductor such as porcelain tubes or flexible tubing.

*Protectors*

*Section 8141. Lightning Arresters-Receiving Stations.*

Change the first sentence to read:

Each conductor of a lead-in from an outdoor antenna shall be provided with a lightning arrester approved for the purpose, except that if the lead-in conductors are enclosed in a continuous metallic shield the lightning arrester may be installed to protect the shield or may be omitted if the shield is permanently and effectively grounded.

*Grounding Conductors-General*

*Section 8151. Material:*

Insert "aluminum" after the words *of copper* in the second line of present text.

*Section 8155. Run in Straight Line:*

Revise this text to read:

The grounding conductor shall be run in as straight a line as possible from the antenna mast and/or lightning arrester to the grounding electrode.

*Grounding Conductors-Receiving Station*

*Section 8162. Size of Protective Ground:*

Insert "or No. 12 aluminum" after the words *No. 14 copper* in the third line.

*Interior Installation-General*

*Section 8181. Clearance from Other Conductors:*

Relocate this text to be section 8191 following the caption "Transmitting Stations."

Also change the word "conductor" in the present third line to "conductors."

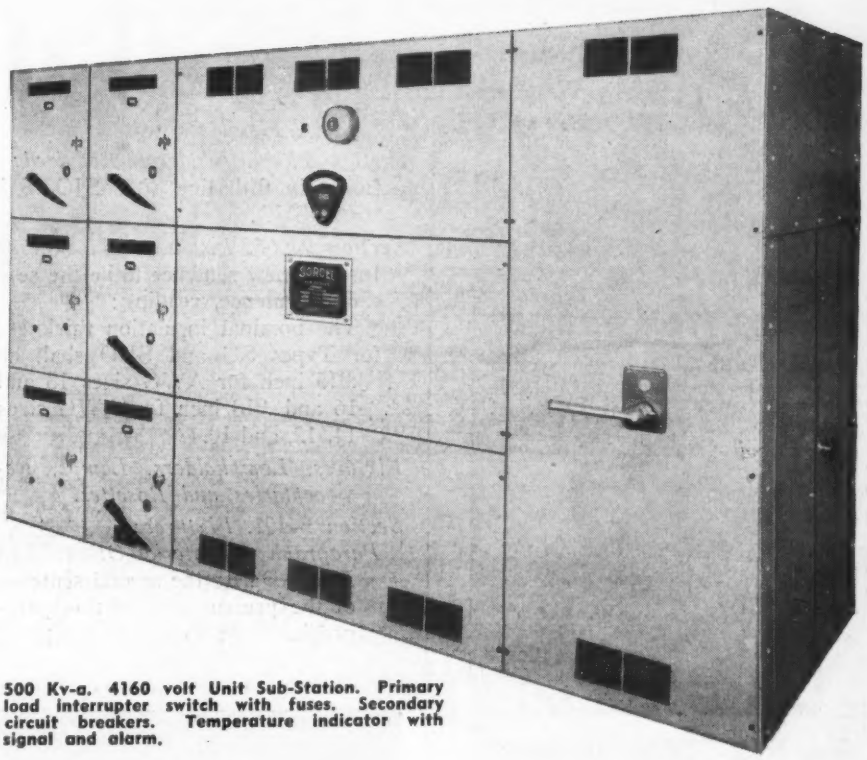
*Section 8182. Radio Noise Suppressors.*

Renumber this section to be section 8181. No change in caption or text.

*Transmitting Stations*

*Section 8191.*


# Power Centers with SORGEL AIR-COOLED TRANSFORMERS



500 Kv-a. 4160 volt Unit Sub-Station. Primary load interrupter switch with fuses. Secondary circuit breakers. Temperature indicator with signal and alarm.

# Unit Sub-Stations

**Complete with primary switch gear, metering, and secondary circuit breakers, all safely encased in steel.**

**Factory wired, assembled and tested. Nothing else to buy or to assemble. Constructed to meet any specifications and requirements.**

**Can be installed anywhere inside of buildings at load centers. Big savings in distribution and installation costs.**

**Also a complete line of other *air-cooled, dry-type* transformers.**

**¼ to 2000 Kv-a. Single phase and poly-phase.**

**All voltages—115 to 15,000 volts, and other special voltages.**

*Sales Engineers in Principal Cities*

**SORGEL ELECTRIC CO., 836 W. National Ave., Milwaukee 4, Wis.**

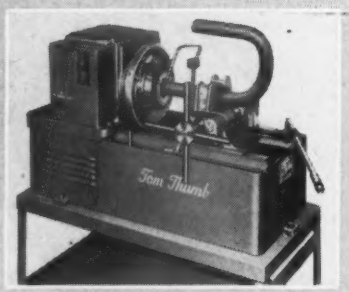
***Pioneers in the development and manufacturing of Air-Cooled transformers***

# CUT PIPE THREADING COSTS

Two Oster "TOM THUMB" Portable Power Pipe Threaders . . . No. 582 for STRAIGHT pipe . . . No. 592 for BENT and straight pipe . . . offer you a selection to meet YOUR particular needs.

**No. 582 "TOM THUMB"**

equipped with STATIONARY type of quick-opening, individual, quick-change die-heads and dies, as desired.




**No. 592 "TOM THUMB"**

equipped with ROTARY type die-head and open type vise for fast accurate threading of BENT or straight pipe.

Both machines are identical excepting the type of die-heads and work holding devices, as noted above.

Standard range (both machines) ¼" to 2" pipe. Extra range ⅛" pipe. Extended range of No. 582 "TOM THUMB" with drive shaft: 2½" to 8". Bolt range (both machines) ¼" to 1½".

Investigate the outstanding features of these two advanced machines. Either one you select is a SURE-FIRE profit-maker! Write for complete information.

OSTER

THE OSTER MANUFACTURING CO.
2081 EAST 61st STREET
CLEVELAND 3, OHIO, U. S. A.


Insert present section 8181, caption and text as proposed above, to be 8191.

Present *section 8191. General.* Renumber to become *section 8192* without other change.

**Chapter 9—Construction Specifications**

*Conductors*

*Section 93101. General:*

*Paragraph e. Conductor Construction:* In the table "Conductor Insulations" change, as follows:

For trade name "Latex" change fourth column of table "8-6" to read "8-2."

Also, for trade name "Latex" insert in table mention of fixture wire, Types RUF and RUFF, in conductor sizes Nos. 18-16, thickness of insulation 18 mils, as for sizes 14-10.

*Flexible Cords*

*Section 94004. Insulation-Required:*

Insert in fifth line after SJO, SU and SUO.

*Section 94005. Insulation Thickness:*

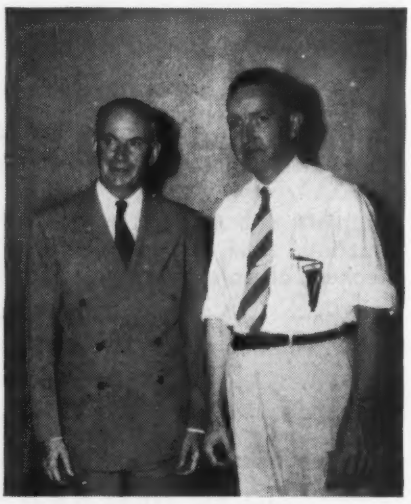
Insert a new sentence to be the second sentence, reading:

The nominal insulation thickness for Types SU and SUO shall be .015 inch for AWG sizes 18 and 16 and .018 inch for AWG sizes 14, 12, and 10.

*Fixtures, Lampholders, Lamps, Receptacles and Rosettes.*

*Section 94101. Fixtures:*

*Paragraph a. Material Other Than Metal.* Delete the second sentence of the present text of this paragraph.



***Radiant heating wiring problems was a topic of discussion between William S. Edsall, President, Chase-Shawmut Co. (left) and D. B. Anderson, electrical engineer, Underwriters' Laboratories, Inc., New York City, who gave a talk on this subject before the Eastern Section, IAEI Annual Meeting, Hotel Statler, Boston recently.***

*Paragraph c. Wiring Space.* Add the following sentence.

Splice compartments shall be of non-absorptive non-combustible material.

*Incandescent Lamps*

*Section 94103. Bases:*

Change to read:

An incandescent lamp for general use on lighting branch circuits shall not be equipped with a Medium base if rated over 300 watts, nor with a Mogul base if rated over 1,500 watts. Above 1,500 watts special approved bases or other devices shall be used.

*Motors and Controllers*

*Section 94304. Identifying Code Letters:*

Revise the table, beginning with present Code Letter R, to read:

| | |
|---|---|
| R | 14.0—15.99 |
| S | 16.0—17.99 |
| T | 18.0—19.99 |
| U | 20.0—22.39 |
| V | 22.4—and up |

**Chapter 10, Tables, Diagrams, and Examples.**

*Tables 1 and 2:*

In heading of column 2 of each table, regarding Type RU, change figure in parenthesis to read, "14—2".

*Notes following Tables 1 and 2:*

Add to fine print note preceding Note 1 additional cross references as follows:

For flexible cords see Tables 3 and 31.

Add as a fine print note to Note 4:

Exceptions to the foregoing are specified in sections 3624, 3745, and 7265.

*Table 3. Allowable Current-Carrying Capacity of Cord and Fixture Wire:*

Change top half of heading of column 4 to read: Rubber Types S, SO, SJ, SJO, SU, SUO, SV, and POSJ.

*Table 13. Dimensions of Rubber-Covered and Thermoplastic-Covered Conductors.*

Change first line of footnote, following double asterisks to read: "No. 14 to No. 2."

*Table 18-a. Multiplying Factors for Converting D. C. Resistance to A. C. Resistance:*

This table (page 328 of the NFPA Edition was omitted from the 1947 edition published by the NBFU (conserving paper supplies). It is recommended for ap-


***Don't Miss the NEW***

**READER SERVICE page 159**

# 5 facts you should know

*... about Magnet Wire Covered with*

## FIBERGLAS* *Yarns*

### 1 What it is

Magnet wire insulated with Fiberglas glass yarns is a basic component of motors, generators, electromagnets, transformers, relays, solonoids, and heating, ignition, and communications equipment. High heat-resistance and moisture-resistance are characteristics of the Fiberglas yarns.

### 2 Where it is used

It is used in apparatus designed to operate at both high and normal temperatures; most frequently where Class B and Class H operating conditions are met. Its use in Class A equipment is increasing. The excellent moisture-resistance and durability of the Fiberglas glass-base insulating materials provide a safety factor sought by many manufacturers of quality electrical equipment. The wire is adaptable to new equipment manufacturing methods and to repair and rewind shop procedures.

### 3 Forms available

Square or rectangular magnet wire insulated with Fiberglas yarns is available single or double serve over bare copper. Servings are bonded to the copper with high-grade insulating varnishes. The finish is smooth and abrasion-resistant. Dimensions available are:

| | |
|---|---|
| Smallest square wire | 14 AWG |
| Largest square wire | 2 AWG |
| Thinnest rectangular wire | .030 AWG |

Round magnet wire insulated with Fiberglas yarns is available single or double serve over bare copper, enamel, or synthetic enamel. Sizes available are:

| | Over Bare Copper | Over Enamel | Over Synthetic Enamel |
|---|---|---|---|
| Largest Round Wire | 0000 AWG | 8 AWG | 8 AWG |
| Smallest Round Wire | 36 AWG | 36 AWG | 36 AWG |

### 4 Who makes it

| | |
|---|---|
| ACME WIRE CO. | *New Haven, Connecticut* |
| AMERICAN STEEL & WIRE CO. | *Cleveland, Ohio* |
| ANACONDA WIRE & CABLE CO. | *New York, N. Y.* |
| ELECTRIC AUTO-LITE CO. | *Toledo, Ohio* |
| ESSEX WIRE CORPORATION | *Fort Wayne, Indiana* |
| GENERAL CABLE CORPORATION | *New York, N. Y.* |
| GENERAL ELECTRIC CO. | *Bridgeport, Connecticut* |
| HUDSON WIRE CO., WINSTED DIVISION | *Ossining, New York* |
| KENNECOTT WIRE & CABLE CO. | *Phillipsdale, Rhode Island* |
| PHELPS-DODGE COPPER PRODUCTS CORP. | *Fort Wayne, Ind.* |
| PHILADELPHIA INSULATED WIRE CO. | *Philadelphia, Pa.* |
| JOHN A. ROEBLING'S SONS CO. | *Trenton, New Jersey* |
| ROME CABLE CORPORATION | *Rome, New York* |

### 5 Who sells it

... electrical distributors and representatives of the manufacturers listed above. If you are unable to locate a supplier, write us at 16 East 56 St., N. Y. 22.

Magnet wire insulation is only one of many types of electrical insulating materials made with Fiberglas yarns. See more comprehensive list below. A new catalog of Fiberglas Glass-Base Electrical Insulating Materials is available. Write for a copy. Owens-Corning Fiberglas Corporation, Textile Products Division, Dept. 856, 16 East 56 St., New York 22, N. Y.

ELECTRICAL INSULATIONS OF FIBERGLAS GLASS FIBERS ARE AVAILABLE IN THE FORM OF YARN • CLOTH • VARNISHED CLOTH • SATURATED SLEEVING AND VARNISHED TUBING • CORD • TAPE • BRAIDED SLEEVING • LAMINATES MICA COMBINATIONS • WIRE AND CABLE INSULATIONS

OWENS-CORNING FIBERGLAS

ELECTRICAL INSULATING MATERIALS

*Fiberglas is the trade-mark (Reg. U.S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with glass fibers.

IF YOU WANT TO KNOW HOW TO CUT YOUR COSTS..

**COME** to Cleveland in January.

**VISIT** the Plant Maintenance Show. See the exhibits. Examine and compare the plant equipment and services that make low-cost production possible.

**ATTEND** the technical sessions. Listen to discussions of the newest and best ways to keep your plant operation at peak efficiency.

PLANT MAINTENANCE SHOW

**YOUR SHOW** . . . for the first time you and other key members of industry's cost-cutting team will have your own show.

**YOUR OPPORTUNITY** . . . an unparalleled one for

- Vice presidents in charge of operations
- Plant managers
- Plant superintendents
- Chief engineers
- Maintenance men

and others whose ultimate responsibility it is to select, install, operate, and maintain the equipment and services needed for efficient, low-cost manufacturing.

PUBLIC AUDITORIUM
CLEVELAND
JANUARY 16-19, 1950
Show Management: CLAPP & POLIAK, Inc.,
341 Madison Avenue, New York 17, N. Y.

pearance in this 1949 Supplement, as follows:

| *Size* | *Multiplying Factor* | |
|---|---|---|
| *C M* | *25 cycles* | *60 cycles* |
| 250000 | ..... | 1.005 |
| 300000 | ..... | 1.006 |
| 350000 | ..... | 1.009 |
| 400000 | ..... | 1.011 |
| 500000 | ..... | 1.018 |
| 600000 | 1.005 | 1.025 |
| 700000 | 1.006 | 1.034 |
| 750000 | 1.007 | 1.039 |
| 800000 | 1.008 | 1.044 |
| 900000 | 1.010 | 1.055 |
| 1000000 | 1.012 | 1.067 |
| 1250000 | 1.019 | 1.102 |
| 1500000 | 1.027 | 1.142 |
| 1750000 | 1.037 | 1.185 |
| 2000000 | 1.048 | 1.233 |

*Table 20. Conductor Sizes and Overcurrent Protection for Motors.*
*Columns 7 and 8.* Throughout the table change mention of Code letter "R" in headings of these columns to Code letter "V".

*Table 26. Maximum Rating or Setting of Motor-Branch-Circuit, etc.*
Change two references in table to Code letter "R" to Code letter "V".

*Table 31. Flexible Cord:*
Insert the following in the list of "Hard Service Cord".
Type letter: SU
Size AWG: 18 to 10 incl.
No. of Conductors: 2 or More.
Insulation: 90% Unmilled Grainless Rubber.
Braid on each conductor: Cotton or Rayon
Outer Covering: Rubber
Use: Pendant or Portable, Damp Places, Extra Hard Usage.
Type letter: SUO
Size AWG: 18 to 10 Incl.
No. of Conductors: 2 or More
Insulation: 90% Unmilled Grainless Rubber.
Braid on each conductor: Cotton or Rayon
Outer Covering: Oil-Resistant Compound.
Use: Pendant or Portable, Damp Places, Extra Hard Usage.

## Iowa Contractors Join Midwest Council

The Iowa Electrical Contractors Association is now an affiliate of the Midwest Electrical Council, Inc., the second group to come into the Council fold this year. The Iowa group's Board of Directors voted the affiliation at their August meeting; brought 23 additional members to the Council roster.

Earlier in the year, the Electrical Contractors Society of Washington (Seattle) also became a Council affiliate. In addition to the above, the Midwest Electrical Council, Inc., embraces the following sponsoring organizations: Minneapolis Electrical Contractors Association; St. Paul Electrical Contractors Association; Minnesota Electrical Association, Inc.; North Dakota Electrical Contractors Association; and South Dakota Electrical Contractors Association.

The Council is now formulating plans for its 1950 Convention to be held in conjunction with the North Central Electrical Industries Convention and Trade Show to be held in St. Paul, Minn., March 5-9.

## Dates Ahead

**International Association of Electrical Leagues** — 14th Annual Conference, Cleveland Hotel, Cleveland, Ohio, October 12-15.
**International Association of Electrical Inspectors**—Southwestern Section, Hotel San Deigo, Calif., October 10-12; Southern Section, Hotel Shamrock, Houston, Texas, October 17-19.
**Detroit Electrical Progress Show**—Sponsored by the Electrical Association of Detroit, Convention Hall, Detroit, Mich., October 22-30.
**National Safety Congress and Exposition**—Chicago, Ill., October 24-28.
**Audio Engineering Society**—"Audio Fair", Hotel New Yorker, New York City, October 27-29.
**National Electrical Contractors Association**—Annual convention, Rice Hotel, Houston, Texas, November 8-11.
**National Electrical Manufacturers Association**—Chalfonte-Haddon Hall, Atlantic City, N. J., November 14-18.
**Sixth All-Industry Refrigeration & Air Conditioning Exposition**—Atlantic City, N. J., November 14-18.
**Electrical & Gas Association of N. Y., Inc.**—Thanksgiving luncheon, Hotel Astor, New York City, November 16.
**Essex Electrical League**—Christmas luncheon, Essex House, Newark, N. J., December 8.
**Electrical & Gas Association of N. Y., Inc.**—Christmas luncheon, Hotel Astor, New York City, December 21.
**Plant Maintenance Show and Conference**—Auditorium, Cleveland, Ohio, January 16-19.
**American Society of Heating and Ventilating Engineers**—Dallas, Texas, January 23-27.
**Southwest Air Conditioning Exposition**—Dallas, Texas, January 23-27.
**American Institute of Electrical Engineers**—Winter general meeting, New York, N. Y., January 30-February 3.
**National Electrical Manufacturers Association**—Edgewater Beach Hotel, Chicago, Ill., March 13-16.
**American Society of Tool Engineers**—Industrial exposition, Convention Hall and Commercial Museum, Philadelphia, Pa., April 10-14.
**Chamber of Commerce**—38th Annual meeting, Washington, D. C., May 1-4.
**National Fire Protection Association**—54th Annual Meeting, Haddon Hall, Atlantic City, N. J., May 15-18.
**National Association Electrical Distributors**—Annual convention, Atlantic City, N. J., June 12-16.

## Manufacturers News

### GENERAL ELECTRIC APPOINTMENTS

With the consolidation of the wiring device and accessory equipment divisions into one division, C. C. Walker, vice president of the General Electric Company and general manager of its construction materials department, has

announced the appointment of G. E. Wickman as manager of the new division.

T. D. Foster has been named manager of sales for the newly formed wiring device and accessory equipment division.

J. J. Lengyel has been appointed manager of sales, construction materials department.

F. Penn Holter has been named manager of manufacturing, construction materials department, succeeding E. J. Harrington who has been assigned to the staff of the vice president in charge of manufacturing policy.

H. Chester Green has been appointed operating manager of the construction material department's Bridgeport regional warehouse.

Dr. Karl B. McEachron has been named manager of engineering for the General Electric Company's transformer and allied product divisions at Pittsfield, Mass. Formerly assistant manager of engineering for the divisions, he succeeds Frederick F. Brand, who has retired after 47 years of service.

Harry F. McRell, formerly manager of sales for the divisions has been named assistant to the manager of the transformer and allied product divisions. Other appointments were Frances E. Fairman, Jr., manager of sales for the divisions; William S. Ginn, assistant manager of sales, and Clement E. Sutton, Jr., manager of the power transformer sales divisions.

## WESTINGHOUSE SUPPLY COMPANY CHANGES

Irvin J. Zorn has assumed the duties of branch manager for the Westinghouse Electric Supply Company house at Allentown, Pa., succeeding Milton Nees, who has been transferred to the Weso Philadelphia apparatus and supply sales department.

Robert J. Grueser has been named branch manager for the Dayton, Ohio, branch. Prior to this appointment, he served as a lighting specialist for the Wesco Cincinnati house.

Announcement has been made of the appointment of N. C. Doxen as South Atlantic district farm sales supervisor, with headquarters at Baltimore, Md.

G. L. Washington has been appointed Southeastern district apparatus and supply sales manager, with headquarters at Atlanta, Ga. He succeeds W. P. Stainback, who has been transferred to the A&S sales department at Atlanta. Prior to this appointment, Mr. Washington was Southeastern district stores manager. He will be replaced in this capacity by J. G. Embry, formerly Wesco Southeastern assistant district stores manager.

V. F. Fox, formerly an apparatus and supply salesman for Wesco Miami, has assumed the duties of manager of the Jacksonville, Florida, branch, succeeding C. W. Spengler, resigned.

GUTH FUTURLITER*

corrals wayward footcandles ...saves steps for eyes!

It beams 80% of the footcandles directly down on the working area...directs 20% upward for eye-easy brightness ratios.

Its dust-discouraging design and hinged eggcrate louvres make it one of the easiest of all fluorescents to keep clean and efficient. Versatile, too...you can mount the Futurliter in units or rows, surface or suspended.

"Eye-to-the-Future" Futurliters give a lighting system flexible footcandle capacity. Up to 45% more light can be had by adding a third lamp to two-lite units.

You'll find detailed data in our handy new Pocket Catalog 46A-A...yours with the compliments of

Guth LIGHTING

YOUR TEAMMATE IN precision-planned LIGHTING

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

Leaders in Lighting since 1902

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MINI-VOLT

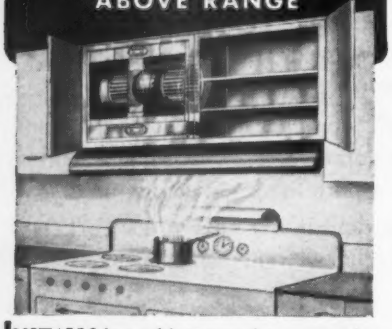
**Instantly read voltages right off dial. 65 to 660 v. AC. Also DC. Virtually burnout-proof. Guaranteed for 25,000 hours' operation. Plastic case. 12" flexible test leads. *And only $2.75 list!***

- **Not only distinguishes between 110, 220 etc. volts, but measures line voltage close enough to show up 2 volt drop between meter and load terminals on 110 v. line.**
- **No electrical worker need now be without definite knowledge of whether faulty operation of motors, or other electrical equipment, etc. is due to improper terminal voltage.**
- **Checks for blown fuses, accidental grounds, circuit continuity. Useful for electrical trouble-shooting in general.**
- **Not subject to error of "False Indication" common to neon test lamps.**

**It's a "must". Saves time, money, life and limb! Order from supplier, or from**

**INDUSTRIAL DEVICES, INC., EDGEWATER 9, N.J.**

NEW *TRADE-WIND SUPER CLIPPER*
INSTALLS IN CABINET ABOVE RANGE



**INSTALLS** in a cabinet over the range or in a canopy or soffit. Twin squirrel cage blowers develop 600 CFM *quietly*. All cooking heat, grease and odors are effectively drawn off the range, while ceiling heat also is drawn off through a second upper inlet. Supplied with 2 cleanable metal air filters. Fold-under hood is optional. Can be installed in any cabinet which provides clear space 18"W x 15¾"H x 11"D. Cabinet not supplied—both St. Charles and Geneva already provide cabinets to take the Super Clipper. Send coupon for complete details.

Trade-Wind Motorfans, Inc.
5709 S. Main St., Los Angeles 37, Calif.
Please send additional information on your Super Clipper

Address_____

Name_____

## U. S. RUBBER APPOINTMENTS

Four divisional managers have been appointed by the electrical wire and cable department, United States Rubber Company, New York, to supervise sales of electrical wire and cable throughout the country.

Clarence H. Le Vee has been named eastern division sales manager, with headquarters in New York City. He will supervise sales in Boston, New York, Buffalo, Syracuse, Philadelphia, Baltimore, Atlanta and Pittsburgh branches.

J. A. Leuver has been appointed western division sales manager with headquarters in Chicago. He will supervise sales in Cleveland, Detroit, Chicago, Cincinnati, Indianapolis, Milwaukee, Minneapolis and Omaha branches.

Don B. Karlskind has been named southwestern division sales manager with headquarters in Dallas, Texas. He will be in charge of branch sales in Birmingham, New Orleans, Houston, Dallas, Kansas City, Tulsa, St. Louis and Denver.

L. M. Guibara has been appointed Pacific coast division sales manager with headquarters in Los Angeles. He will be in charge of branch sales in Los Angeles, San Francisco, Portland, Seattle and Salt Lake City.

## WESTINGHOUSE APPOINTMENTS

Two executive appointments in the industry sales departments of the Westinghouse Electric Corporation have been made recently. R. S. Kersh becomes manager of central station sales and F. D. Weatherholt has been appointed manager of industrial sales. Both will be located at the East Pittsburgh plant.

J. C. Fink, formerly manager of the industry engineering department, has been named assistant to A. C. Monteith, vice president in charge of engineering.

Henry N. Muller, Jr., manager of the educational department has been named assistant to the vice president in charge of engineering. In addition to his new engineering duties, Mr. Muller will continue to direct the educational department.

Hendley N. Blackmon, managing editor of *Electrical World* since 1947, has been appointed assistant manager of engineering association activities. He will be located at the East Pittsburgh Works and assist Frank Thornton, Jr., manager of engineering association activities.

The appointment of G. L. MacLane, Jr., as manager of the engineering laboratories has been announced. He succeeds Thomas L. Spooner, who has retired after 40 years of service.

James E. Woodall has been named manager of the Fairmont, W. Va., plant of Westinghouse Lamp Divisions. John Rosevear, former manager at Fairmont, becomes staff assistant to Mr. Woodall.

John A. DeGroot, formerly of Pittsburgh, Pa., has been transferred to the San Francisco office of Westinghouse and appointed to the post of assistant to the Pacific Coast district manager. Mr. DeGroot succeeds W. J. Howell of Burlingame, who has been appointed assistant to the corporation's apparatus sales manager at Pittsburgh.

W. C. Rowland has been named manager of the company's manufacturing and repair division.

R. P. Wagner has been appointed manager of the industrial products advertising and sales promotion department. He will be located in Pittsburgh. Mr. Wagner succeeds J. H. Thomson who has joined Electrical Publications, Inc., Cleveland, as a vice president.

## PENNSYLVANIA TRANSFORMER CHANGES

At a recent meeting of the directors of Pennsylvania Transformer Company, Pittsburgh, Pa., Samuel Horelick, who for the past 20 years has been president of the company, was elected to the newly created position of chairman of the board.

W. E. Kerr was elected president. Mr. Kerr has been vice president and treasurer of the company since it was organized in 1929.

W. R. Swoish, sales manager, was

**W. R. SWOISH**

elected vice president. He will also continue as sales manager.

Samuel Dickson was elected treasurer; F. W. Dierker, assistant treasurer; and Miss A. M. Slater, secretary.

## GRAYBAR APPOINTMENTS

Announcement has been made of the appointment of Hamilton Corey as branch manager at Charlotte, N. C., of Graybar Electric Company. He succeeds Y. P. King, who is retiring.

J. E. Carroll has been named commercial general sales manager of Graybar with offices at 180 Varick Street, New York. In his new position, Mr. Carroll will be responsible for providing special service to customers of the company who operate in several of its sales district.

## WESTERN INSULATED APPOINTS M. OWEN SALES MANAGER

The appointment of Murray Owen as general sales manager of Western Insulated Wire Company, Los Angeles, Calif., has been announced.

Mr. Owen joins Western after 28 years with the General Electric Co.

Mr. Owen went with General Electric in 1920, and in 1922, at the time

MURRAY OWEN

of the organization of the York Wire Division, he was transferred to that plant. Several years later he was appointed manager of the entire York Division of G-E, in charge of engineering, manufacturing and sales. During his last three years there, prior to his retirement, he was in charge of G-E's electrical cord and cable division, construction material department.

## O. C. STARK NAMED SALES MANAGER OF PHOTOSWITCH

Photoswitch Incorporated, Cambridge, Mass., has announced the appointment of Oscar C. Stark as general sales manager, with headquarters in

O. C. STARK

the factory sales office, New York City.

Mr. Stark had been with Square D Company since 1930 in various sales and management capacities. Before joining Square D, he was associated with the New York sales office of the General Electric Co.


YOU CAN BE SURE.. IF IT'S

Westinghouse

"Muscle"

MORE

FOR ELECTRICAL APPARATUS

...at no extra cost

Your apparatus can have higher electrical stamina . . . longer operating life . . . if insulated with Westinghouse "Tuffernell" Insulating Varnishes.

Outstanding among these new varnishes are Tuffernell B-161, B-163, and B-165. All are thermosetting; and each has specific properties of high resistance to heat . . . moisture . . . centrifugal force . . . and to other enemies that break down ordinary varnishes.

It is because of these properties that Baker-Raulang, of Cleveland, chose Tuffernell B-163 for their well-known line of industrial trucks, tractors, and cranes. They like B-163's deep penetration of windings, giving better heat transfer and cooler-running motors. They have found, too, that B-163 is economical and faster to use, and stands up in rugged service.

The complete Tuffernell line includes Insulating Varnishes and Compounds for *your* application. All are described in Bulletin 65-120, available on request.

Investigate Tuffernell today for your needs. Call your nearby Westinghouse office, or write Westinghouse Electric Corporation, Dept. 13, P.O. Box 868, Pittsburgh 30, Pennsylvania.

J-06418

Westinghouse

TUFFERNELL INSULATING VARNISHES

—for every electrical need

ELECTRICAL CONTRACTORS AND ESTIMATORS

*This new book shows*

# HOW TO ESTIMATE THE COST OF ANY ELECTRICAL JOB

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**Fairbanks, Morse & Co.,** Chicago, has announced the appointment of Frank M. Mason, Jr., as director of engineering. He will continue to be located at the Chicago office.

•

E. F. Luna, formerly advertising manager of **Anaconda Wire & Cable Company,** has been appointed sales promotion manager of the company. This newly created function will cover sales-advertising liaison, new product promotion, market analysis, market development, sales training, publicity and customer and public relations.

•

Dudley K. Bailey, until recently a member of the sales engineering staff of the **Weston Electrical Instrument Corporation,** Newark, has joined the sales staff of the Beedle Equipment Company, Cincinnati. The Beedle Company is the Cincinnati district representative for Weston products.

•

K. D. Busbee has been appointed southwestern district representative of **Oliver Iron and Steel Corporation,** pole line sales division. His headquarters will be at Dallas, and he will report to the Corporation's southern sales headquarters at Birmingham, Ala.

•

**Triangle Conduit & Cable Co., Inc.,** New Brunswick, N. J., has established warehouse facilities in Boston at 215 A Street. The warehouse is under the supervision of Triangle's Boston District Manager James J. Slater, who has moved to the new headquarters.

•

**Cornish Wire Co., Inc.,** New York City, has appointed Alexander Norden, Jr., to organize and develop a new division, The Wired Assemblies Division, which will concentrate upon the designing, engineering and manufacturing of staple and specialized electrical wire assemblies for manufacturers of electrical equipment.

•

The firm name of **Automatic Electric Heater Company,** Pottstown, Pa., has been changed to **Sepco Corporation.**

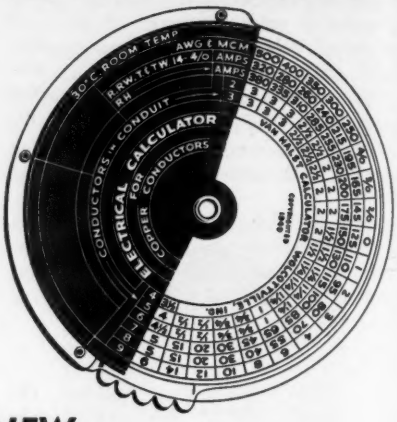
•

**The Superior Electric Company** of Bristol, Conn., has named R. J. Caccavelli as manager of its Chicago sales office.

•

**F. W. Wakefield Brass Company** of Vermilion, Ohio, has announced the appointment of Charles W. Carr as sales representative for the Pittsburgh territory.

## *Quick Answers to Conduit Problems!*

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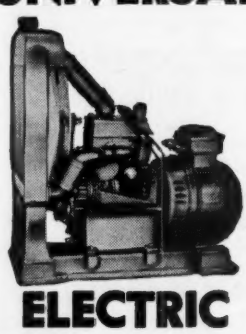
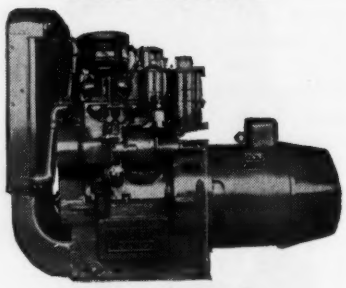


## ELECTRIC



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**Sylvania Electric Products Inc.**, New York City, has announced the appointment of Charles H. Goddard as manager of utility sales. In his new assignment, Mr. Goddard will be in charge of sales of all lighting equipment to municipalities, railroads and other transportation companies, central station sales and large utility accounts.

•

A special department, devoted solely to constructing sample wire assemblies, has been set up by **E. H. Titchener & Company** of Binghamton, N. Y.

•

John D. Tebben & Company, Detroit, Mich., has been appointed sales representative by **Gibson Electric Co.**, Pittsburgh, Pa. They will cover the state of Michigan and Toledo, Ohio.

•

**Flexible Tubing Corporation**, Branford, Conn., has announced the appointment of A. H. Loux as manager of distributor sales for the company.

•

Appointment of R. W. Capaul as general sales manager of **Glass Fibers, Inc.**, Waterville, Ohio, has been announced. He was formerly manager of the Electrical Division.

•

**Jasper Blackburn Products Corp.**, St. Louis, Mo., has named Ken Way as assistant sales manager.

•

**Revere Electric Manufacturing Company**, Chicago, has opened a west coast warehouse at 926 Natoma Street, San Francisco.

•

**John A. Roebling's Sons Company**, Trenton, N. J., has opened a new office and warehouse at 4801 Jackson St., Denver, Colo. Homer H. Davis will serve as manager.

•

**Victor Specialties** of New Rochelle, N. Y., has announced the appointment of John J. Spath, Inc., as manufacturers representative in the Metropolitan area.

•

Robert H. Robinson has been appointed sales manager of **William Brand & Co.**, New York City.

•

**The Electric Products Company**, Cleveland, Ohio, has appointed J. R. Williams as district manager of its Chicago office.


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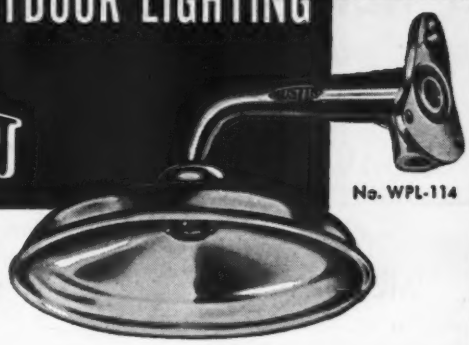

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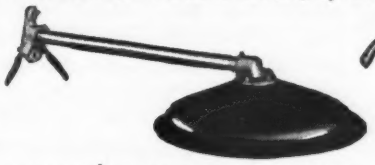

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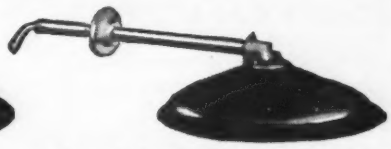

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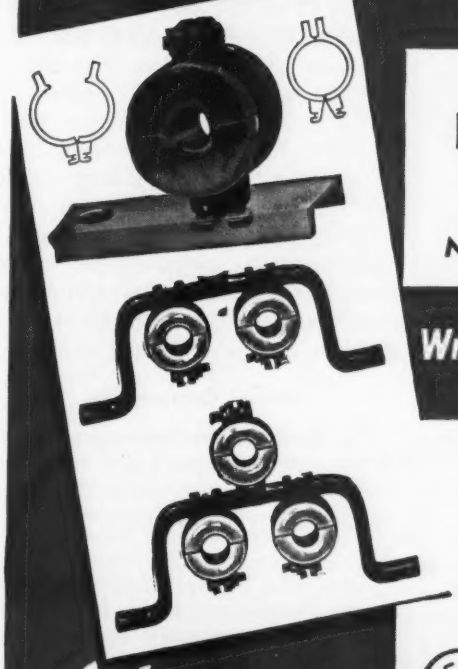

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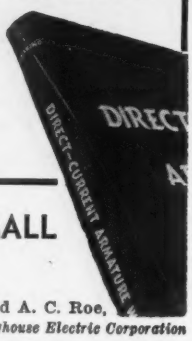


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## ELECTRIC RADIANT HEATING

[FROM PAGE 49]

hour. (This calculation has been simplified for the purpose of the example. Several other considerations affect heat loss in floors set on concrete pads. They will be explored in more detail in future articles. The heat loss given is higher than would be likely to occur in this type of construction.)

*Step 5.* The ceiling area is similarly measured. The U factor is .08. However, in this instance the heating system consists of ceiling panels and the temperature difference involves the panel temperature, 110 degrees. The ceiling heat loss totals 8880 Btu. per hour. (This has also been simplified for the purpose of the example. On actual installations the ventilated blind attic would be sealed and additional insulation applied to reduce the ceiling heat loss.)

*Step 6.* The infiltration of outside air is determined, between 1 and 1½ changes an hour is normal, in homes with good weather-stripping often less. For 8000 cu. ft. per hour at .018 Btu. per cu. ft. per degree the heat requirement is 11,080 Btu. per hour.

*Step 7.* Totalling the heat losses gives 37,757 Btu. per hour. To this must be added capacity to pick-up temperature or to offset large momentary losses (through open doors for instance). This has been set at 10 percent. The system capacity in Btu. per hour now totals 41,533 or in electrical system capacity (41,533 divided by 3413) 12.2 kilowatt-hours per hour or 12.2 kilowatts of connected load.

For most such calculations, slide rule accuracy to three figures is sufficient. U factors and design temperatures are both approximations. The error in rounding 41,533 to 41,500 is small compared with the probable error in the factors and their applications.

### *Annual Consumption*

To determine the approximate use in kilowatt hours per year, we return to the total heat loss per hour before the pick-up is added, 37,757 Btu. per hour.

To change this to Btu. per hour per degree, we divide by the design temperature difference, 70 degrees. The remainder is 539 Btu. per hour per degree difference in temperature. Multiplying by 24 gives 12,936 Btu. per *day* per degree difference in temperature. Now we have a figure which can be multiplied by the known degree-days of the area to give the annual heat loss


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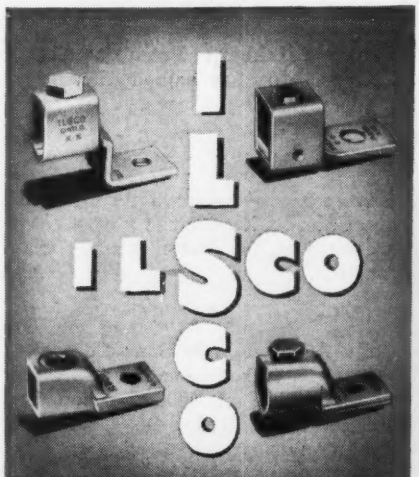


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in Btu's, which can be converted into kilowatt-hours by dividing by 3413. In this example, the total annual consumption is 18,940 kilowatt hours.

Since every project requires an analysis of total heat loss at design temperature, it is most convenient to derive annual kilowatt-hour consumption directly. A standard factor applying to most jobs in a given area may be set up as follows:

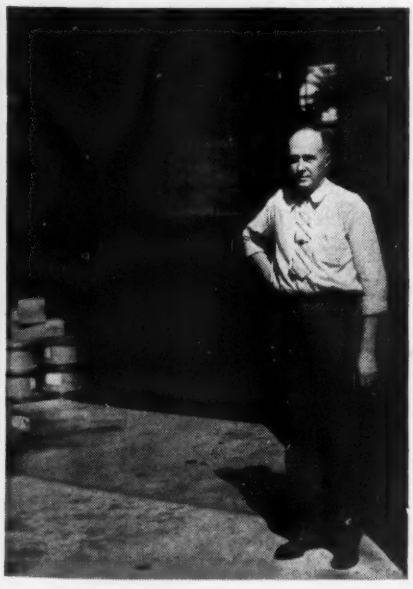
$$F = \frac{24 \times \text{degree days}}{\text{design temperature difference} \times 3413}$$

then $F \times T.H.L.$ = Annual kilowatt hours.

In the above example using 5000 degree days and 70 degree temperature difference factor F is .50. For Wichita, Kansas with design temperature difference of 75 (−5 degree design temperature, 70 degree indoor temperature) and 5101 degree-days it is .48. For Minneapolis, 90 degree difference, 7989 degree days, the factor is .60.

In the example, the maximum heat loss would require 12.2 watts per square foot over the whole ceiling area (12,200 watts divided by 1000). The highest losses, however, are near the walls over the windows and the lowest in the center of the house. Further, the individual rooms must be kept at even design temperatures even though their exposure or heat losses are not in exact ratio to their ceiling areas.

The next article in this series will discuss how the heating system is laid out and balanced to meet individual room conditions and to provide for local control.



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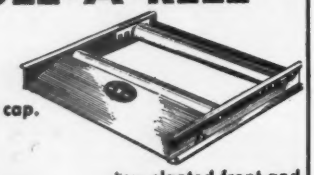

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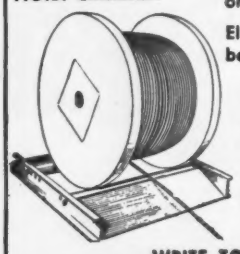

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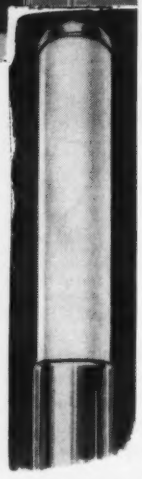

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## EMERGENCY SIGNAL SYSTEMS

[FROM PAGE 51]

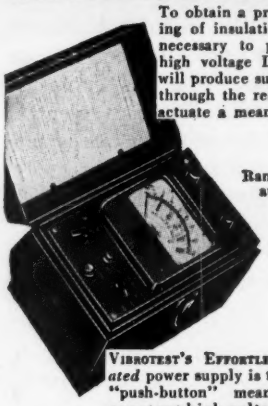
Operating machinery in industrials may be provided with manual or automatic emergency signals. These are used to indicate a breakdown or a stoppage of production. In the manual type, a tumbler switch or pushbutton may be placed on or adjacent to the machines. The operation of these stations will cause a lamp to light above the machine at a height to insure clear vision for a reasonable distance, and in addition will light a lamp and operate an audible signal in an annunciator located in the superintendent's office. Where the noise is great, a loud audible signal such as a horn may be extended from the annunciator. An automatic system would be similar to the manual signal system except that the alarm would be initiated without aid from an individual. As an example, contacts may be attached to the governors or feeders of the machines, or a photoelectric ray may be focused upon a certain point, and when interrupted or uninterrupted as the case requires, close the circuit to the signals.

Blower fans in duct systems may be provided with automatic signals which detect an abnormal or dangerous increase in temperature and disconnect the fan motor. Occasionally fire originates in duct systems as a result of an accumulation of lint and dust which has become ignited. Stoppage of the blower prevents the fire from spreading to other points and possibly to rooms being served by the duct system. A typical signal system of this type is shown in Fig. 3. The thermostatic detectors of the rate-of-rise and fixed temperature type are mounted inside of the ducts and at points near the blowers. When a sudden quick increase of temperature occurs, or if the temperature rises to 165° F, the contacts in the detector operate and causes a relay or automatic switch to become energized, thus resulting in the switch or relay contacts to open the circuit to the blower motor circuit. In addition, an indication is shown on an annunciator together with the sound of a bell as an audible signal. In lieu of this form of a signal, the relay or switch may operate an electrically tripped transmitter which in turn sounds a coded signal designating the point of origin on the existing fire alarm bells or a series of separate audible signals.

Standby current supply sources are used in many ways to insure the proper functioning of alarm and process sys-


**HOW TO MEASURE INSULATION RESISTANCE**

To obtain a proper megohm reading of insulation resistance, it is necessary to provide a constant high voltage DC potential which will produce sufficient current flow through the resistor under test to actuate a means of indication.



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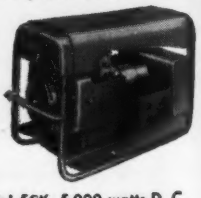
D. C.: 750 to 15,000 watts.
*Diesel plants:* 2,500 to 55,000 watts.



*Write for Folder*

Model 5CK, 5,000 watts D. C. Weighs only 315 lbs.

Onan PRODUCTS

D. W. ONAN & SONS INC.
3170 Royalston Avenue
Minneapolis 5, Minnesota.

tems. When an interruption of current occurs, a means of substitution must be automatically and instantly provided. There are several ways of accomplishing this, the method selected depends upon the prime source of current available and upon the design of the equipment to be operated. For instance, in a system normally supplied by direct current, a throw-over switch may be provided to connect a storage battery, a standby service, or a gas generator of the same voltage. Where a system is normally supplied by alternating current a throw-over switch may be provided to connect a standby service or a gas generator of the same voltage. A rectifier may also supply current from an alternating current source and provide direct current to a system under normal conditions. The throw-over switch may then connect a storage battery to the system in the event of an interruption of current. An illustration of the latter system is shown in Fig. 4.

Elevator emergency signal systems are used to summon assistance in the event of power interruption, defective controls or brakes, stoppage between floors and any other condition which may endanger the passengers. There are two general methods of summoning assistance. One is to install a telephone in each cab for two-way conversation to and from the master telephones at the starters location and in the superintendent's office. The other method consists of a pushbutton or switch in each cab with a bell mounted on the underside of the cab or mounted in the elevator shaft. A series of coded signals will identify the source of the signal.

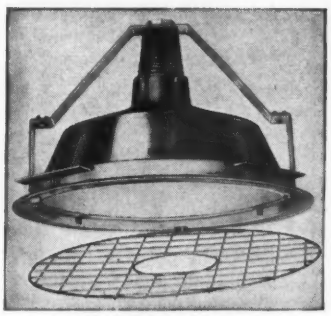
Vault emergency call signal systems are used to summon assistance in the event of an accidental confinement or an enforced confinement of an individual or several employees by intruders. There are two general methods used to summon assistance. One is to install a telephone within the vault enclosure which may be connected directly through the telephone switchboard or directly to the police department. The other method consists of a pushbutton or switch which when operated lights a lamp adjacent to the vault, and another lamp and an audible signal near the guard's desk. Unless guard service is provided continuously a telephone system with exterior line service is preferable.

An interlocking door control system is shown in Fig. 5. It is used where two doors allow access to the same room, and where the simultaneous opening of both doors would permit


"HINDSIGHT IS BETTER THAN FORESIGHT"

*NOT SO WITH THIS FIXTURE.*

A SIGHT ON MAINTENANCE OF THIS UNIT WILL CHANGE THIS WISE SAYING TO "FORESIGHT SPECIFIES MULTI-LITES"



CATALOG NO. 3088

Servicing from above or below suspended ceiling is easy with this multi gymnasium fixture. Two thumb screws hold detachable saddle permitting reflector to be lifted up through plaster ring. Threaded neck of reflector permits easy removal from below. Catalog No. 3088 with hinged wire guard covers the entire unit illustrated. 300-500 watt reflector is heavy gauge steel porcelain enamel finish, white inside, green outside.

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JENKINS *Gold Seal Tapes*

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HANDLE WIRE FAST!

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HyKon MFG. CO.

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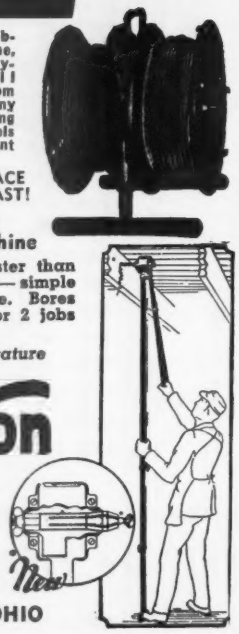
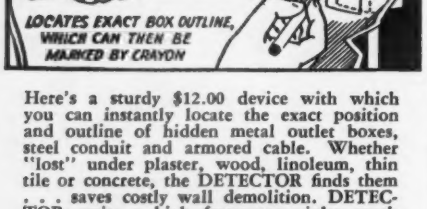



Find "LOST OUTLETS" The Easy Way
with this amazing tool . . .

THE OUTLET DETECTOR




Here's a sturdy $12.00 device with which you can instantly locate the exact position and outline of hidden metal outlet boxes, steel conduit and armored cable. Whether "lost" under plaster, wood, linoleum, thin tile or concrete, the DETECTOR finds them . . . saves costly wall demolition. DETECTOR emits a high frequency violet spark (when box is detected) from tip of removable steel "MARKER" electrode.

★ Residential, Commercial and Industrial Contractors all need several OUTLET DETECTORS.
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★ Price is only $12.00 postage prepaid. Includes DETECTOR unit with 6 ft. of rubber cord. Safety design employs 12" knurled bakelite case, with spark volume control knob. Operates on 110 A.C. or D.C.

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Please send me.....OUTLET DETECTORS at $12.00 each (postage prepaid)
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light or drafts to penetrate and interfere with or destroy photographic, chemical or other laboratory processes. When both doors are closed, the operation of the pushbutton at a designated door causes the current to pass from the transformer to its associated electric door-opener for that entrance, then through a closed-circuit door spring installed in the jamb of the second door. The first door-opener becomes energized and releases when the door is pushed. On the other hand, if the second door should be opened at that moment, the door springs would be on open-circuit and therefore the first door could not release.

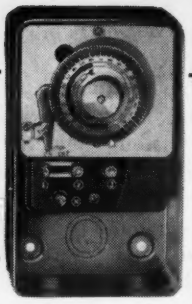
Watchman's delayed alarm and emergency signal should be incorporated in every electrified watchman's system. The delayed alarm is used with or without a time clock, and the alarm is sounded automatically at any specified location when a transmitting station is not visited within an established time period set by the control mechanism. It warns of an interrupted tour and the need for immediate investigation. In most cases this alarm is extended wherever possible by leased line to the local police department facilities. The emergency signal originates at a special watchman's station or stations, and is operated by the watchman's tour key as he progresses with his visits from one station to the other. It is arranged that a signal may be given to the supervisory office for immediate aid when an emergency arises.

An automatic door release system for fire exit doors may be provided on practically every fire alarm system. Normally these doors are locked as they are only to be used for emergencies. Each door is equipped with a door-opener. When an alarm is transmitted from a fire alarm station these door locks or openers are energized simultaneously with the sounding of the fire alarm sounding devices. The interlocking equipment is located in the fire alarm control panel.

Air conditioning emergency disconnect systems are used in large installations. They permit a system to be shut-down by an attendant or other individual in the event of gas or refrigerant leakage. The emergency stations are of the non-code break-glass fire alarm station type except for the word "Emergency" which indicates its use. When the class of the station is broken, a switch is operated automatically and disconnects the power from the air-conditioning machinery.

Refrigerator emergency signals are used to summon assistance in the event of an accidental confinement of an in-


LOOK!



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UNLOCKS TREASURE HOUSE . . .

. . . of Buying Information

Mr. P. E. Bomgardner, shown above, is responsible for specifying, buying or otherwise influencing the purchase of electrical machinery, equipment and supplies for the General Engineering Co. Inc. of Reading, Pennsylvania.

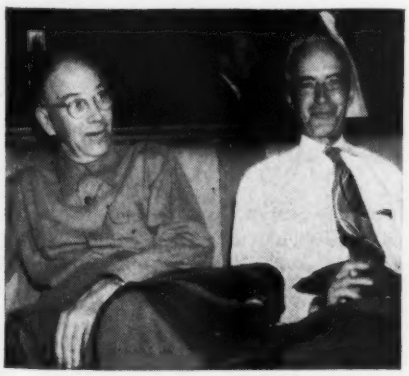
For saving time in locating suppliers and comparing their products, he finds the PRE-FILED ELECTRICAL CATALOGS invaluable as a "treasure house" of product data. Mr. Bomgardner says of the ELECTRICAL CATALOGS: ". . . *it is used almost daily and is of extreme value to us in locating items required in our work.*"

If PRE-FILED ELECTRICAL CATALOGS is not available for buying reference at your plant, write to McGRAW-HILL CATALOG SERVICE, 330 West 42nd Street, New York 18, N. Y.

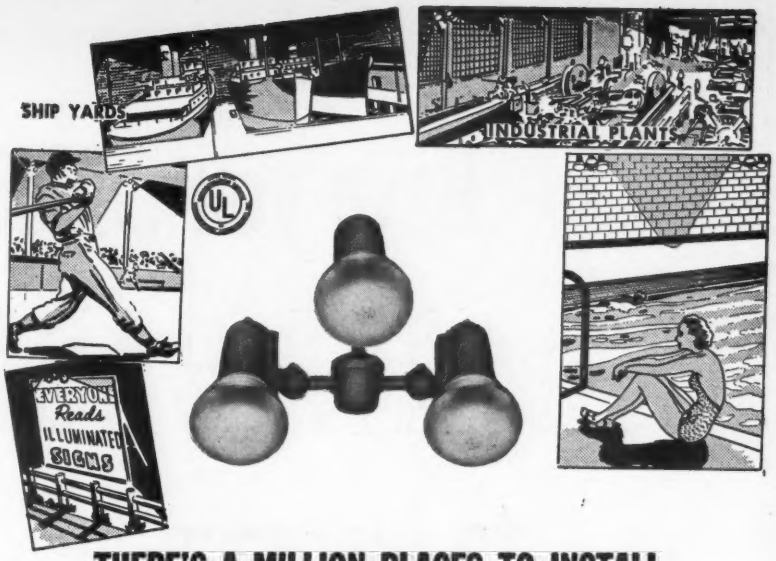
dividual. There are two general methods employed. One is to install one or more telephones within the enclosure such as sound powered types which are not affected by temperature and dampness. These may be connected directly to the superintendent's and the watchman's desks. The other method consists of one or more watertight pushbuttons installed within the enclosure with a lamp outside and over the door of the respective section of the refrigerator, and a lamp in an annunciator with an audible signal located at the supervisory points.

Valve and contact switch emergency signal systems are used in industrials for the control of processes and for safety purposes. They are used in the latter manner in many other types of buildings and institutions. The valves may control the flow of steam, air, gas, water, oil and other fluids. By means of contacts associated with them, a signal may be given at any location should an abnormal condition arise, that is, should the flow start or stop. Contact switches may also be provided on manual shut-off valves to indicate the condition of the valve, that is, whether they are open or closed. Connection may be made to annunciators at supervisory locations to give an audible or visual signal or both if desired. These circuits may also be connected to coded transmitters which will advise of the origin of the alarm or signal. A punch recorder may be added to the coded type of systems to produce a permanent record of each signal.

Emergency signal systems may be applied to conveyors, fire doors, mines and refinery apparatus and in many other ways almost too numerous to mention. A solution may be found in practically every case with thorough study of the conditions and the material available on the market.



***Electrical Inspectors W. E. Wiley (left) and T. R. Huber, City of Rochester, N. Y., took part in Code Chats and other program activities of the IAEI's Eastern Section Annual Meeting in Boston.***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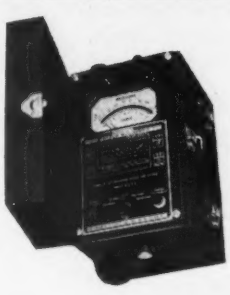


NON-CRANKING "MEGOHMERS" MODEL B-7

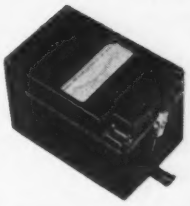
Steady test potential 500 volts DC, 4 ranges in 1 instrument: 0-20/200 megohms, 0-200/20,000 ohms.

MODEL B-6

4 instruments in 1, 6 ranges: 0-200 megohms, 0-2000 ohms, 0-150/600 volts AC, 0-150/300 volts DC.

*Full details in Bulletin 440/441.*

GENERATOR TYPE "MEGOHMERS"



"MINOR" 0-50 megohms, 500 volts DC variable pressure

ALSO "STANDARD" SIZE

Constant pressure generator 500 volts, or 1000 volts DC. Ranges 100 megohms, 1000 megohms and 2000 megohms.

*Full details in Bulletin 450/455.*

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# Have you considered AVA CABLES to increase power load without changing present raceways?

If you're up against the problem of increasing power load without increasing raceway size, here's a practical solution: rewire with General Electric Deltabeston® asbestos-varnished cambric cables.

Yes, on many electrical construction or modernization jobs in dry locations,* where heavy loads are involved, you may be able to work substantial savings with Deltabeston cables.

Deltabeston cables are insulated with heat-beating asbestos . . . are built for locations where operating temperatures are usually high. When used at normal ambient temperatures, they can safely carry far greater loads for their size than building wires with other kinds of insulation. In some instances, this heat-defying insulation actually enables Deltabeston AVA cables to deliver up to 49% more current per raceway.†

And for new construction, too, they can often effect real savings. Because their insulation permits smaller conductors, Deltabeston AVA cables can actually cut raceway size requirements as much as 40%.‡

To you, Deltabeston AVA cables mean *installation speed,* because they can help on many jobs by reducing the size of cables you put in — *material savings,* because AVA cables can safely carry extra current per raceway — *weight savings,* because small size means light weight.

It will pay you to look into the suitability of General Electric Deltabeston AVA cables for all your jobs involving heavy loads. For more information, consult your General Electric wire and cable distributor.

**For a free folder that gives detailed information, write for Bulletin 19-159. Address Section W59-1018, Construction Materials Dept., General Electric Company, Bridgeport 2, Conn.**

*As defined by the National Electrical Code.

† The figure was worked out for AVA cables at 1000 MCM. Larger and smaller sizes give similar savings.

‡ This figure was worked out for a load of 470 amperes. Similar savings can be realized for other loads.

GENERAL ELECTRIC

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| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
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*want interpretation on a code provision?*

**Electrical Construction and Maintenance is written for you by a large staff of editors and consultants, each an authority on some phase of the business. They will be glad to give you expert advice and answers to your questions.**

*other problems? turn the page for the answer.*

Dear Editor:

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***Ask the editors.***

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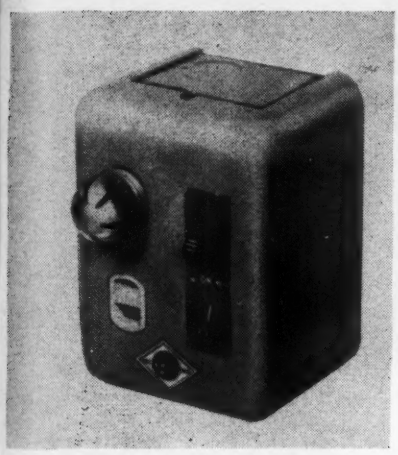
# Product News



### Outlet (1)

A metal wallbox combining an auxiliary circuit breaker, a convenience outlet, and a pilot light is now available. Any electrical apparatus plugged into the outlet is protected by the magnetic circuit breaker against overloads and short circuits, while the pilot light serves as a reminder that the circuit is in use. Device is adaptable for use on assembly lines, in laundries, workshops, etc. Standard ratings: 115 volts, 6, 10, 15 amps.; 230 volts, 6, 10 amps. Other ratings to 50 amps. maximum. Listed by Underwriters' Laboratories.

*Heinemann Electric Co., 132 Plum Street, Trenton, N. J.*

### Slimline Lamps (2)

Two new slimline fluorescent lamps, one and one-half inches in diameter (T-12) and four and six feet long, respectively, have been announced. They were developed as companions to the recently announced eight-foot-long lamps of the same diameter. Lamps are designed for instant-start operation, and may be operated at the same brightness level as the 96-inch lamp. Both lamps have single pin base construction, and use standard "push-pull" slimline lampholders. They are available in three shades of white—white, 4500 white, and warm tint. The three sizes of one and one-half inch diameter slimlines permit flexibility in various lighting applications, such as those in stores, offices, factories, schools, homes, showrooms, restaurants, theaters and elsewhere.

*General Electric's Lamp Department, Nela Park, Cleveland, Ohio.*

### Selenium Rectifier (3)

A new selenium electroplating rectifier, Model EPF, 4304, has been announced. Component parts are transformer, rectifier stack, fan, contactor and connections. It operates on 220 or 440 volts, 3 phase, 60 cycles, d-c, 2000 amps. at 6 volts or 1000 amps. at 12 volts, continuous duty. Dimensions are 63 in. high, 32 in. wide and 21 in. deep.

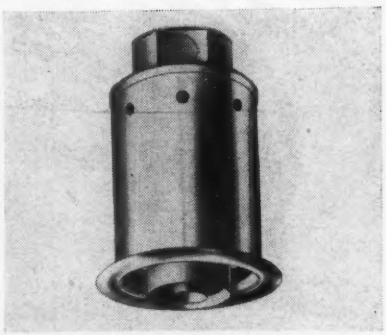
*Electric Products Company, 1725 Clarkstone Road, Cleveland 12, Ohio.*

### Switch (4)

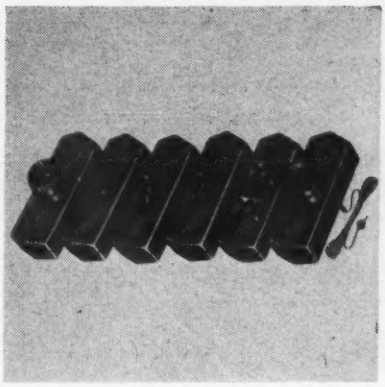
A new Model 71 Levolier switch, 15/32-inch thick, has been announced. It is suitable for installation in shallow lighting fixtures and canopies, FHP motor controls and other places where switch space is limited. It is a 6 amp. "T" rated 125 volt switch, incorporating the Levolier type switch mechanism and lever control. Housing is molded of phenolic plastic. It is 1 9/32-in. wide and 1 9/64-in. long. Six-inch wire leads are permanently fastened to terminals by pressure connections in place of soldered connections. Each switch has a lever and pull chain and six foot linen cord and bell. It carries Underwriters' approval.

*McGill Manufacturing Company, Inc., Valparaiso, Ind.*

### (5)



**RECESSED REFLECTORS,** ***known as "Top Hats" are for use with R-40 lamps and suitable for unusual architectural treatments, for supplementary incandescent lighting, and other applications. Can be used with sun lamps in the home. Manufactured by Edwin F. Guth Company, 2615 Washington Avenue, St. Louis 3, Mo.***



### Wiring Devices (6)

Special arc-resisting urea compound bases are featured in these new surface wiring devices. They can be used in basements, attics, garages, barns, cabins, warehouses or on any surface wiring job. They will take either non-metallic or armored cable (using an armored cable and ground continuation clamp) and are made in single-pole and three-way switches, keyless and pull chain lampholders, double outlet and junction box or rosette. Switches are "T" rated and outlets have double wipe contacts. They are listed by Underwriters' Laboratories and meet Federal and REA specifications.

*Monowatt Incorporated, 66 Bissell St., Providence, R. I.*

### Cable (7)

A new non-metallic sheathed cable, known as RoBarn, has been added to this line. Developed to meet the requirements of the interior wiring of farm buildings where ammonia fumes and other corrosive elements shortens the life of wiring materials, RoBarn is Neoprene protected against moisture, acids, alkalies, oxidation and flame. In addition to an outer Neoprene sheath, individual conductors are Neoprene covered for protection against oxidizing elements in junction and outlet boxes. Between assembled conductors and outer sheath is a closely woven glass braid for increased strength and flame resistance. Available in 14, 12 and 10 AWG—2 and 3 conductor—RoBarn is approved by Underwriters' Laboratories and labeled for use as non-metallic sheathed cable.

*Rome Cable Corporation, Rome, N. Y.*

# *Modern Fittings for*

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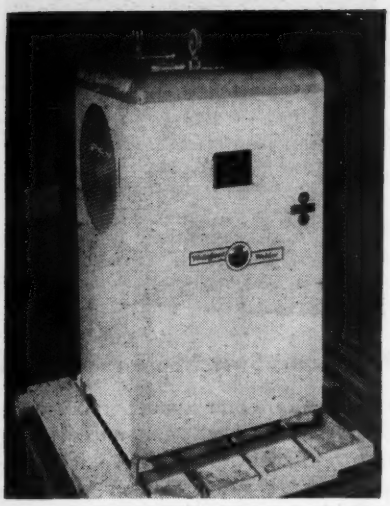


## Welder (8)

New d-c welding machines, using plate-type rectifiers, instead of the conventional rotating components used in motor-generator welding equipment, are available. They are rated in accordance with NEMA standards for industrial type, single-operator, arc welders. Available in 200-, 300-, and 400-amp. ratings. Major components are three-phase welding transformer; three-phase adjustable reactor; and, a plate-type (selenium) three-phase, full-wave rectifier. The no-load loss in a 300-amp. welder is 500 watts. The power factor at normal operating load conditions is comparable to induction-motor-driven welders.

*Westinghouse Electric Corporation, Pittsburgh 30, Pa.*

## Starter (9)

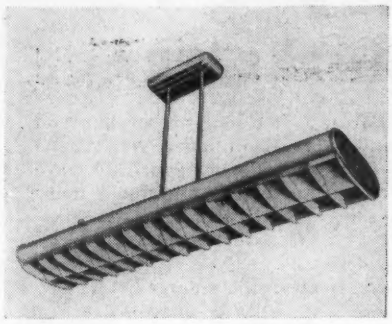
A new wall-mounted, full-voltage starter, Type 371, especially adaptable for use in chemical, liquid fuel, milling, coal handling and other industries in which corrosive vapors or combustible dust laden atmospheres are present, has been announced. Entire mechanism is immersed in oil and sealed from the atmposphere. It is weatherproof and can be used for outdoor installations. Starter enclosure is corrosion resistant. Starter controls squirrel cage motors and primary of wound rotor motors of 350 hp. or less at 2300 volts. It is actuated by a pilot device, such as pushbuttons, float, pressure switches, or similar devices. Either undervoltage protection or release may be incorporated in the control circuits used in conjunction with the starter. A built-in drum type multistage auxiliary switch provides for extra circuits in the control system.

*Allis-Chalmers Mfg. Co., Milwaukee, Wis.*

## Slot Insulators (10)

Standardization by means of definite styles, a new development in the marketing of fabricated paper parts for insulation of armature or rotor slots, has been announced. Fourteen standard styles, covering the most popular types of slot insulators, known as Inmanco, have been developed. These include plain, scored, cuffed and formed styles. Many different paper materials are available.

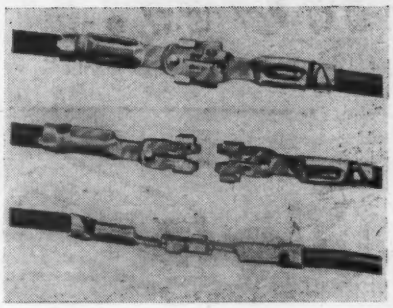
*Insulation Manufacturers Corporation, 565 West Washington Blvd., Chicago 6, Ill.*



## Lighting Fixture (11)

A new fluorescent lighting fixture for classrooms, offices and stores has been announced. Called the CL-242, it is a two-lamp 40-watt unit with a bottom louver and luminous plastic side panels. Fixture can be mounted surface or pendant, individual or continuous row. For pendant mounting, either single or double stems can be used. No mounting plates are required for surface mounting. Re-lamping has been made easy by the removal of either of the plastic side panels, which sit in holding tabs in the end plates.

*Sylvania Electric Products Inc., 500 Fifth Avenue, New York, N. Y.*



## Disconnect (12)

The new "Sta-Kon" wristlock disconnect consists of two identical halves, which can be meshed and locked securely together by hand. It makes a positive electrical connection, features a brazed barrel giving extra strength and also insulation grip. It was designed particularly for use with relays, signal or elevator equipment, many types of fractional horsepower motors or any equipment or devices that are demountable or are used in installations where connecting dis disconnecting may be expected. Approved by Underwriters' Laboratories.

*Thomas & Betts Co., Inc., Elizabeth, N. J.*

## Outlet (13)

A new convenient safe power outlet, known as Swinglet, has been announced. It is for use in work rooms and is installed in correct location for work, eliminating trailing cords on floor. It is for two wire and three wire cord attachment plugs. The three wire cord attachment plug carries the appliance circuit through Swinglet to the approved ground. It hangs in a free acting, swivel joint which avoids angular strains on cords.

*Porwoll Electric & Mfg. Co., St. Cloud, Minn.*

**TO BE ANNOUNCED NEXT MONTH**

**Watch for these new products to be announced shortly. The following information is based on late or incomplete reports at press time.**

**Porcelain Connector of new small size, .656 in. by .375 in., for joining small wires up to 1-14 and 1-16.**
**Poultry Timer, 30 ampere rating with dimming feature for extending lighting period in poultry houses.**
**Self Rotating Electric Hammer Drill of electromagnetic design with free striking piston and rotating drive.**
**Aluminum Grid Louvered Ceiling with associated fluorescent fixture designs.**
**Varnished Cambric Cables by a well known manufacturer of special duty wire and cable products.**
**Slimline Lamps in new 48 in 40 watt and 72 in. 60 watt sizes in the same construction as the popular 75 watt, 8 ft. T 12 with some starting features and 6000 hour life.**
**Connection Box requiring no cable bends equipped with solderless lugs and deep cover which affords unrestricted working space when removed.**
**Bar Hanger with snap on stud adjustable for between-stud installation.**

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Since its founding in 1930, ARRO has won recognition as one of the nation's major manufacturers of expansion bolts and other anchoring devices, serving the hardware, mill supply and plumbing supply trades. For years, our goal has been to increase our service to the electrical field.

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*The Anchoring Devices You Want . . . . .*

Machine Screw Expansion Anchors in sizes from 6/32 screws to ¾" bolts inclusive.

Two-Wing Spring Type Toggle Bolts in Screw sizes ⅛" to ½" inclusive.

*. . . . and the Tools You Need to Use Them*

Arro-Spin Drills — Genuine Carboloy cemented carbide tips — for electric rotary drills. Round and fluted shanks; broad range of sizes.

A full line of Arro Star Drills in sizes from ¼" to 2" diameter; lengths to 24".

**If your distributor doesn't have ARRO products, write us for name of ARRO distributor nearest you.**

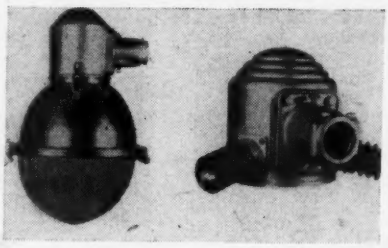
## ARRO EXPANSION BOLT COMPANY

**MARION, OHIO**

### Panel and Switchboard (14)

New "Lo-Ohm" panel and switchboards have been announced. They feature the new "Lo-Ohm" quick make, quick break safety switch housed in individual standardized switch units. Each unit constitutes a circuit and has its own safety interlocked cover. Units provide wiring space for front connection. Individual switches are front operated. Boards are available as free standing aisle structures or wall panels, single or double branch construction in capacities of 30 to 200 amperes with a rating of 250 volts. All units are horsepower rated for control work and approved by Underwriters' Laboratories.

*Metropolitan Electric Mfg. Company, 22-50 Steinway St., Long Island City 5, N. Y.*



### Street Lighitng (15)

Type AK-10 and Type AK-14 street lighting luminaires featuring the Universal metal head with a new "latch-on" attachment are available. Designed for system standardization, these units are interchangeable at the junction of the head and the reflector with similar units meeting proposed EEI-NEMA standards. Type AK-10 is designed for use with 2,500 to 10,000 lumen incandescent lamps, series or multiple, as well as C-H5, F-H1 or E-H1 mercury vapor lamps. Type AK-14 provides Type IV and Type V distribution patterns and is designed for use with 10,000 or 15,000 lumen incandescent lamps and C-H5, F-H1 or E-H1 mercury-vapor lamps.

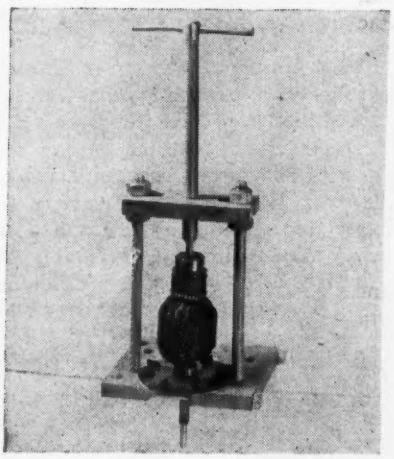
*Westinghouse Electric Corp., Pittsburgh 30, Pa.*

## Coded-Wire (16)

A new wire for electric controls, using numbers instead of color-coding has been announced. Called "Magic Wire", each wire has its code number imprinted in bright red on every inch of yellow insulation. The new wire is useful for automatic control systems, printing presses, aircraft, trucks, busses, signal devices, traffic lights, elevators and other equipment using multiple-wire electric controls. Also available in No. 16 solid wire with plastic insulation.

*Midwest Automatic Control Co., 510 Third St., Des Moines, Iowa.*

(17)



**NEW TOOL** ***under four pounds, which takes the place of an arbor and assorted step plates in removing and replacing fans, ball bearings, races and seals from shafts, armatures etc. Manufactured by Double B Tool Co., 1561 E. 27th Street, Cleveland 14, Ohio.***

## Extension Reel (18)

A new model of the Port-O-Reel, weighing nine pounds without cord, has been announced. While size of cord governs amount of cord which can be wound onto reel, the new model will accommodate 150 feet of No. 16, two-conductor cord or its equivalent in diameter. It will accommodate greater lengths of cords of smaller diameter. Kink and knot-free re-winding may be accomplished at a rate of about 10 ft. per second. Improvement has been made in the design of the double constant contact collector ring which enables cord to be used while reel is turning, and re-designed method of attaching cord makes it easy for cord to be changed if reel is used for different cord.

*Industrial Electrical Works, Omaha, Nebraska.*

(CONTINUED ON NEXT PAGE)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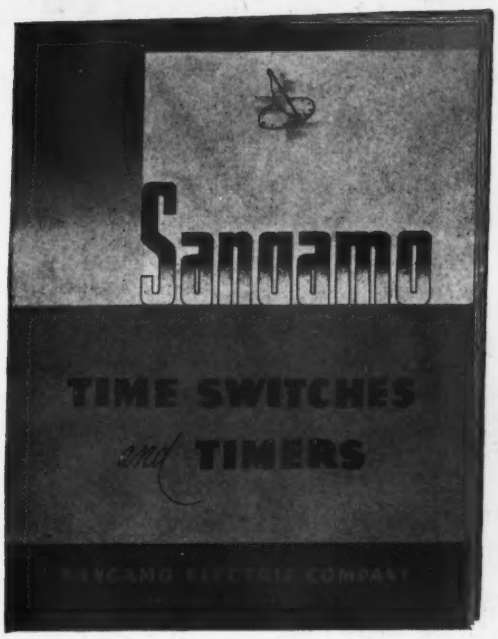
*This Important New Catalog!*




Every time switch user will find practical answers to time control problems in this unusual new 16 page catalog. It contains complete information, specifications, wiring diagrams and prices—everything you need to help you choose the *best* possible switch or timer for your next installation.

Fill out the coupon below for your free copy. No obligation, of course.

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**You can do every kind of soldering with this new 250 watt Weller Gun. Power-packed, it handles heavy work with ease—yet the compact, lightweight design makes it equally suited for delicate soldering and getting into tight spots.**

**Pull the trigger switch and you solder. Release the trigger, and off goes the heat—automatically. No wasted time. No wasted current. No need to unplug the gun between jobs. 'Over and under' position of terminals provides greater visibility with built-in spotlight. Extra 5¼" length and new RIGID-TIP mean real soldering efficiency.**

**Chisel-shape RIGID-TIP offers more soldering area for faster heat transfer, and new design gives bracing action for heavy jobs. Here you get features not found in any other soldering tool . . . advantages that save hours and dollars. Your Weller Gun pays for itself in a few months. Order from your distributor or write for bulletin direct.**

**SOLDERING TIPS**—get your copy of the new Weller guide to easier, faster soldering—20 pages fully illustrated. Price 10c at your distributor, or order direct.

**WELLER**
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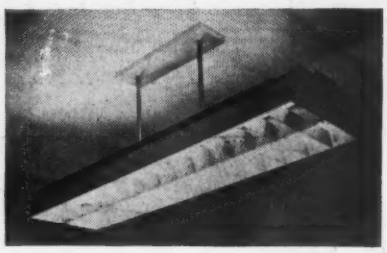
**815 PACKER STREET • EASTON, PA.**

## Street Lighting Units (19)

A complete line of fluorescent luminaries designed for outdoor street and highway lighting applications has been announced. Designated as the "200 Series" the line consists of three models—Form 200 for traffic thoroughfare lighting; 201 for lighting bridges, viaducts and airport approaches; and 202 for tunnel and underpass illumination. Form 200 consists of a long tubular-shaped, aluminum housing in which may be mounted two or four 8-foot long slimline fluorescent lamps. It has been designed for conventional spacings and mounting heights. Form 201 is designed principally for use on rails, fences, and parapets where low-level mounting is desirable. Each unit is equipped with an 8-foot slimline lamp. Form 202 is for tunnel and underpass lighting, consists of an anodized aluminum reflector in which is mounted a single 6-foot slimline lamp, and a clear plastic cover hinged to permit servicing and relamping. Mounted end-to-end, it provides a continuous path of light along tunnel.

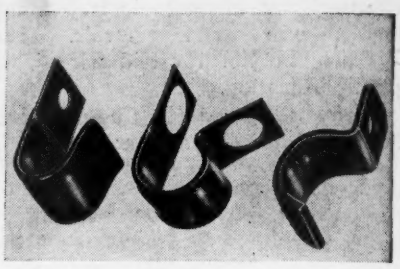
*General Electric Co., Schenectady 5, N. Y.*



## Fluorescent Unit (20)

A new all-metal fluorescent luminaire, known as Berkeley, designed particularly for stores, offices and general commercial interiors, has been announced. Downward distribution of light provided is shielded 40° crosswise and 30° lengthwise. Approximately 43% of total light output is directed upward. If no upward light is desired, baffles may be attached to top of reflector to provide totally direct type of luminaire. It is designed for individual suspension mounting with twin-stem or single-stem hangers, or for surafce mounting without hangers. Units may be joined end-to-end to form continuous rows. Unit uses two 40 watt general line fluorescent lamps.

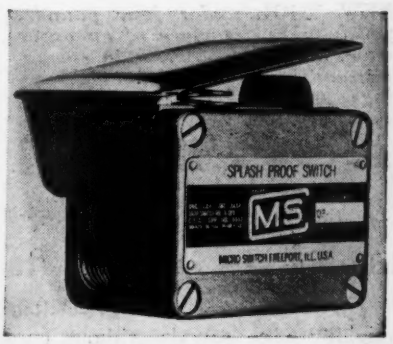
*Miller Company, Meriden, Conn.*



## Insulated Clips (21)

Rubber insulated clips, clamps, and fasteners have been standardized. They are designed to prevent slipping, chafing, cutting and rattling in the securing of wire, loom, tube, pipe, cable, rod, etc. Available in a variety of shapes and each in a wide range of sizes. Exposed metal ends can be parkerized, zinc plated, cadmium plated, lacquered or enameled to suit the need.

*Automotive Rubber Co., Inc., 8601 Epworth Blvd., Detroit 4, Mich.*




## Splash-Proof Switch (22)

A heavy duty splash-proof precision switch with a "plate" type actuator has been announced. While designed for locations subject to the splash of oil, water, and coolant, it is especially advantageous on equipment where operator safety demands two-hand control switches. Switch housing has a gasketed cover plate and a closely fitted actuator shaft through the housing wall which serve to protect the enclosed switch unit from the entrance of dust, dirt and splash of oil, water or coolant. Rating is 15 amps., 125, 250 or 460 volts, a-c. Circuit arrangement is single-pole, double-throw.

*Micro Switch, Freeport, Ill.*

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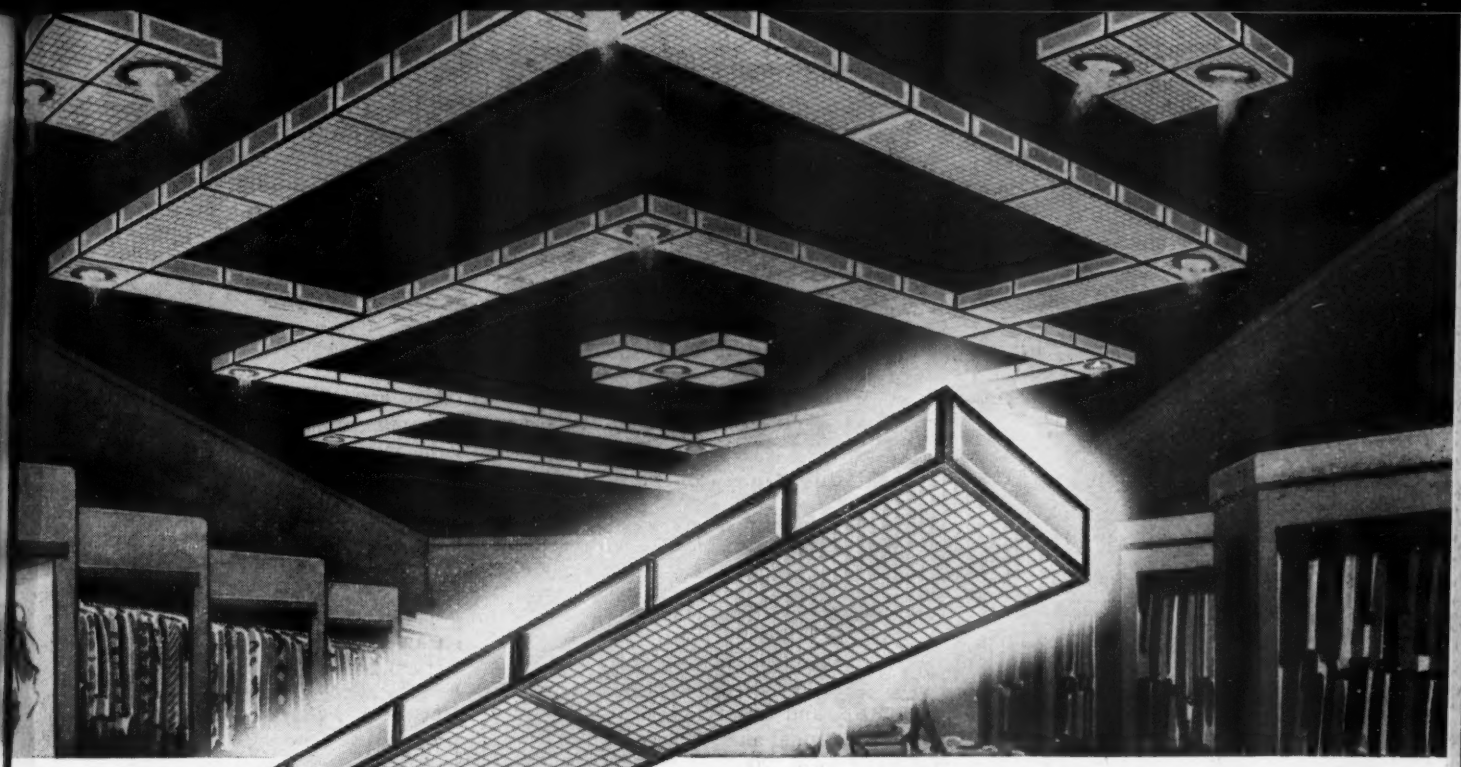

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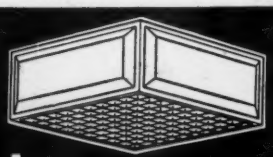
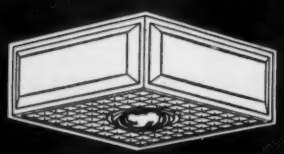
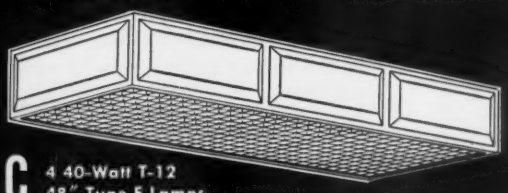


**A** 4 14-Watt T-12
15" Type F Lamps

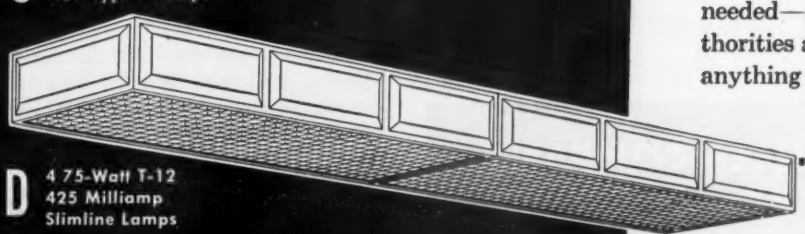


**B** 1 32-Watt 12" Circline Lamp, & 1 PAR Spot or Flood Lamp

these 4 modules are the "building blocks" of the Mitchell Module Lighting System



**C** 4 40-Watt T-12
48" Type F Lamps



**D** 4 75-Watt T-12
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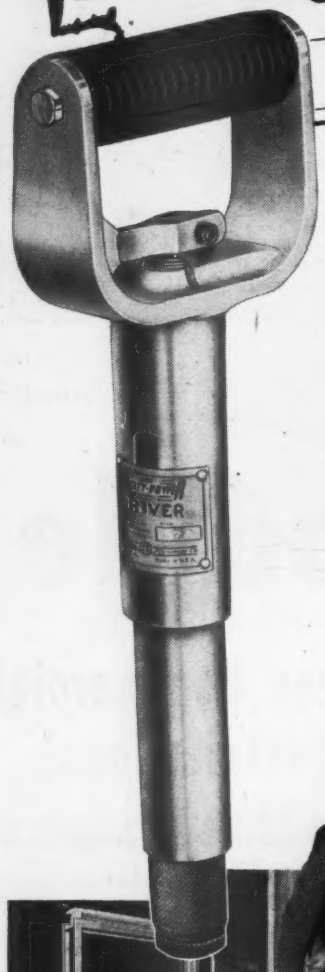

*One of many applications:* metal door frames, anchored with 4 studs to concrete in less than 5 minutes per frame! That's a typical performance record with the amazing M.S.A. Velocity-Power DRIVER—the *safety-engineered* powder-actuated tool that is revolutionizing stud-driving jobs throughout industry. Just load, position, and fire—stud is in place as easy as 1-2-3!

Only the M.S.A. DRIVER uses an integral stud-piston and cartridge assembly that prevents ricochet, flash, recoil and disturbing noise. Only the M.S.A. DRIVER is built by the world's largest manufacturer of industrial safety equipment. Write for the facts—ask for a demonstration!

Operator firing ¼" threaded stud through bottom flange of metal door frame into concrete floor.

Door frame in place, held by 4 Velocity-Power studs—ready for tile-block installation.

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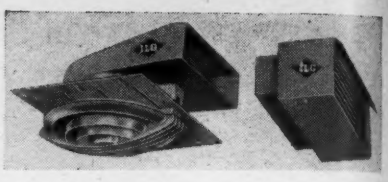
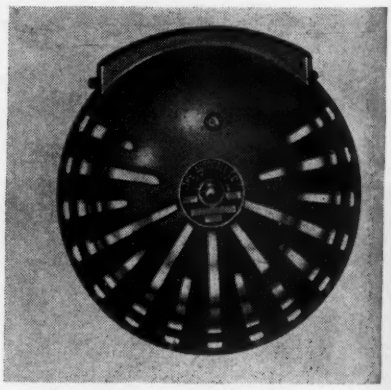
54 BRANCH OFFICES IN THE UNITED STATES AND CANADA



## Ventilator (23)

Development of a new ceiling-type kitchen ventilator has been announced. Completely automatic, it is controlled by a standard light switch. A spring booster control on the insulated discharge damper opens the damper when the ventilator is started, and closes it when it is turned off. Standard 3¼-in. by 12-in. wall stack duct and elbows are recommended for use with the ventilator. Mounting plate is adjustable to permit installation flush with ceiling in plaster or plywood construction. Fan housing contains a built-in electrical box.

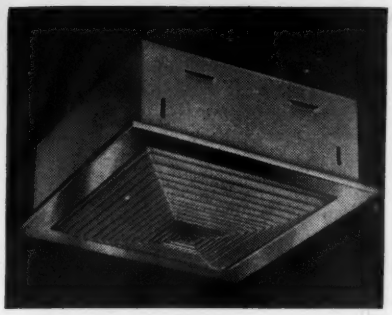
*Ilg Electric Ventilating Company, 2850 N. Crawford Ave., Chicago 41, Ill.*



## Weatherproof Bell (24)

A new weatherproof alarm bell for either single-stroke or vibrating operation has been announced. The mechanism consists of a solenoid coil in which a loose-fitting plunger operates. Mechanism is supported by a glazed porcelain terminal block mounted in a cast aluminum back box that serves as a housing and also as an outlet or pull box. A molded neoprene gasket around the edge of back box seals the cover and back box tightly to provide a dust and weatherproof housing. They are designed for surface mounting and three slotted lugs are provided. Knockouts are provided in the sides, bottom and back of back box to permit use of one-half inch of BX cable. Porcelain bushings are supplied when bell is to be used with open wiring. They are available in 8, 10 and 12-inch sizes for operation on 3 to 250 volts, a-c or d-c. Approved by Underwriters' Laboratories and Factory Mutuals.

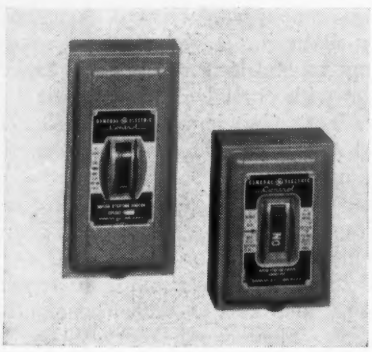
*Autocall Company, Shelby, Ohio.*



**Incandescent Fixture** **(25)**

A new line of recessed incandescent lighting fixtures in rounds and squares has been announced. The entire new line, covering 60 models in seven different sizes and a wide variety of styles, is for residential as well as commercial installations. Depth on round units is 5 inches, while squares range in depth from 4 to 5½ inches. Round units, of heavy gauge one-piece aluminum, are vented to assure cool operation and are available with aurora prismatic lens, Corning pyrex-fresnel lens or concentric louver. The squares, of heavy gauge steel, are also vented and may be had with aurora prismatic lens, semi-flush dropped lens, Corning pyrex-fresnel lens or combination of egg-crate louver with glass.

*Litecraft Manufacturing Co., 104 So. Fourth St., Brooklyn 11, N. Y.*



**Starters** **(26)**

A new line of manually operated starters for a-c motors up to 7½ hp. has been announced. They are specially designed for use on farm machinery, textile looms, and small pumps, blowers, and grinders. They are furnished in both toggle and pushbutton types in 2-, 3- and 4-pole forms, Size 0 and 1. Toggle operated types in above forms and sizes are also furnished, if desired, with cast iron enclosures for use in wet, dust-laden, or hazardous locations. A feature is bimetallic overload protection. Starters are equipped with a wide range of heaters. To prevent tampering, all starters in general purpose enclosures can be padlocked.

*General Electric Company Schenectady, 5, N. Y.*

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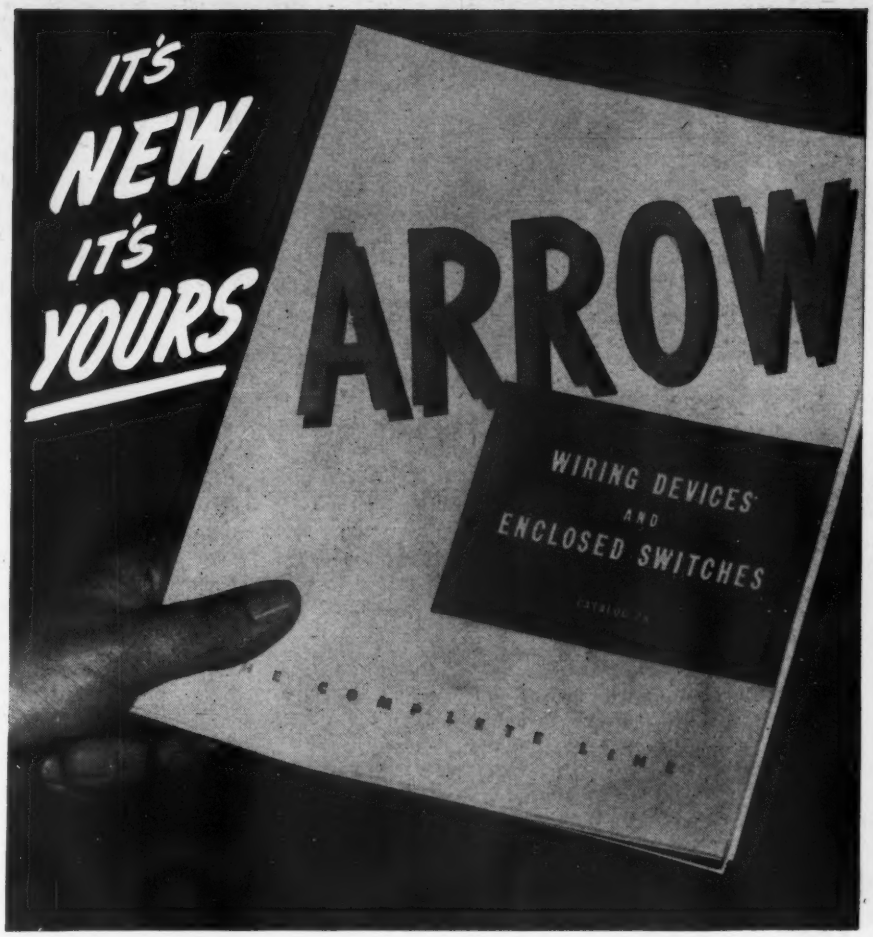


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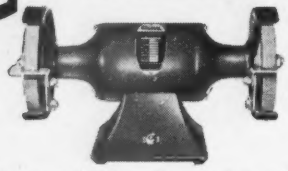
3 NEW Signal PRODUCTS

Designed to help you do your job Better and Faster!

NEW 6" Bench Grinder

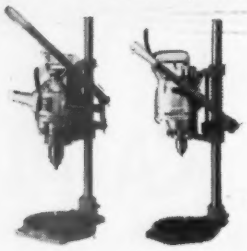


*Signal's* versatile bench grinder will handle anything from heavy grinding to polishing. Available in two models.

Model G-141, ¼ H.P. **$49.30** List

Model G-131, ⅓ H.P. **$58.00** List

NEW Drill Stands



*Signal's* stationary drill stands convert any *Signal* portable drill into handy drill press. Available in two models.

Model DS-1, for ¼" Drills **$26.60** List

Model DS-2, for ½" Drills **$37.80** List

NEW Conversion Kit

*Signal's* Conversion Kit allows you to use your *Signal* Drill for on-the-job grinding, sanding, buffing or polishing.

Model BA-230, complete **$3.75** List

**See Your *Signal* Supplier or write for FREE literature!**

Signal SIGNAL ELECTRIC MFG. CO. Dept. C-6 Menominee, Michigan

### Splice Caps (27)

Splice caps with insulators for pigtailing wires from No. 14 to No. 6 are now available. It is installed by means of crimping tool having four converging plungers which draw splice cap and inserted wires into solid permanent mass. Installed cap is insulated by pushing molded insulator over splice cap and turning red security ring to lock insulator in place. Approved by Underwriters' Laboratories, Inc. and Canadian Standards Association for usage in circuits to 600 volts.

*Buchanan Electrical Products Corporation, 1290 Central Ave., Hillside, N. J.*

### Regulator (28)

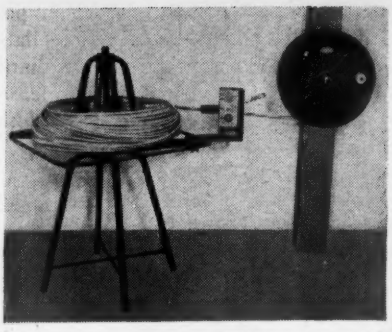
A packaged regulator assembly especially suited to small airports is available. It is designed to supply 6.6 amperes to medium intensity runway, strip, or taxiway lights and meets the requirements of CAA specifications. A direct manual type is available in 2½- and 4-kw. sizes and a remotely operated unit is supplied in 1½-, 2½- and 4-kw. ratings. The static regulator assembly includes two capacitors and two reactances which are balanced to produce 6.6 amperes on the secondary when 240 volts are applied to the primary. The primary has additional taps for line voltages of 220, 230 or 250 volts. The 2½- and 4-kw. units, either manual or remote, are available with secondary taps to provide 6.6, 5.5 or 4.8 amperes for three stages of brightness. Breakers are included in direct manual unit for incoming power supply, and for auxiliary lighting circuits such as obstruction lights, wind cone, beacon, etc.

*Westinghouse Electric Corp., Pittsburgh 30, Pa.*

### Tubing (29)

Large size flexible plastic tubing, to replace the fiber conduit and fiber and steel elbows formerly used on cable riser poles, has been announced. This new tubing is used to cover the cables at the bend from the U-duct on the riser pole to the ducts under the cross arms. Tubing covers all exposed cable and projects about six inches inside each duct. Duct ends are then sealed by tape and compound to prevent entrance of water or moisture. It is specially compounded for resistance to corrosive elements in the atmosphere, and moisture. Available in various sizes and wall thicknesses as required.

*Irvington Varnish & Insulator Co., Irvington 11, N. J.*



### Wire Measuring Reel (30)

A new wire measuring unit complete with wire meter and storeroom reel is now available for all wire measuring applications. Wire is quickly and easily unrolled, measured and recoiled, trouble free of knots and kinks. Wire and cable sizes to 1 inch diameter can be measured and registered up to 1,000 feet. Wire measuring equipment consists of a storeroom reel stand, an 18 inch individual reel, and a wire measuring device. Meter is also available separately.

*HyKon Manufacturing Co., 163 E. State St., Alliance, Ohio.*

### Fluorescent Unit (31)

The new Hartford luminous downlight luminaire, available with three types of hinged door enclosures, has been announced. Hinged door with non-shattering Polystyrene lens; hinged metal louver door; and hinged door with crystal clear prismatic Lucite lens. Unit is available in 48-, 72- and 96-inch lengths. In 48-inch lengths for use with 2 or 3 40-watt fluorescent lamps and in 96-inch lengths for use with 4 or 6 lamps. And in the 72- and 96-inch lengths for use with 2 or 3 T8 200 or 300 ma. slimline fluorescent lamps and 2 T12 425 ma. slimline lamps. They can be close-ceiling or suspension mounted, individually or in continuous row.

*Miller Company, Meriden, Conn.*

### Switch (32)

A new dead front triple pullout combination service entrance switch and panel has been added to this line. Designed primarily for compactness and minimum on-the-job wiring for residences requiring electric range and water heater, the new unit also has many commercial and industrial applications as a feeder panel in stores, lofts and factories. Unit is equipped with 100 amp. main lugs feeding the 60 amp. pullout switch which energizes from four to twelve lighting circuits. Branch circuit block will accommodate fuses of non-tamperable type. Two appliance

pullouts are internally wired in parallel with main lugs and are available for either 30 or 60 amp. Appliance pullouts are non-interchangeable.

*General Switch Corp., 49 Roebling St., Brooklyn 11, N. Y.*

### Motor Protector (33)

A new flush type "Motor Sentinel" for the protection of single phase motors up to 1 hp. has been announced. When overloads endanger the motor, the bimetallic thermostat trips the "Sentinel" giving positive protection. Mechanism is enclosed in a bakelite housing. Devices are top wired, equipped with plaster ears and designed for mounting in standard two inch deep boxes and accommodate standard tumbler switch flush plates. They are available in single pole and double pole types. The basic switch unit is uniform for all installations of single pole and double pole flush types.

*Bryant Electric Company, Bridgeport 2, Conn.*

### Instrument (34)

A new miniature Frahm resonant-reed tachometer has been announced. It requires no contact with rotating element and imposes no load on machine under test. It measures vpm as well as rpm. and is available in various ranges between 1000 and 13,000 rpm. Cases are available to accommodate one or three instruments, or 60° or 90° brackets for permanent mounting.

*James G. Biddle Co., 1316 Arch Street, Philadelphia 7, Pa.*

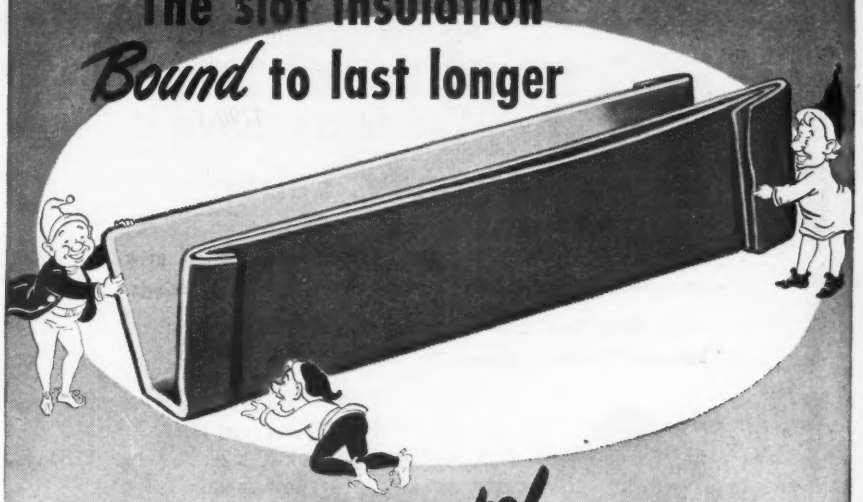
### Float Switch (35)

A new flange mounted tank float switch, for condensate pumps, has been designed for automatic control of liquid level within closed tanks. Switch may be mounted in either the vertical or horizontal plane. Adjustments permit contacts to open or close on liquid rise in either position. Without removing switch from an installation, float travel may be adjusted in the field, within moderate limits, by removing the cover and adjusting two lock nuts. Switch will function properly under a pressure of 25 pounds per square inch. The operating mechanism is of the positive snap action toggle type. A watertight seal is insured by a graphite coated asbestos, used in the stuffing box.

*Square D Company, 4041 North Richards Street, Milwaukee 12, Wis.*


IRV-O-SLOT

The slot insulation *Bound* to last longer



*Won't Migrate! Won't Delaminate!*

**The big news** about Irv-O-Slot is good news for motor manufacturers. This famous slot insulation, with all its excellent electrical characteristics, benefits by a new, specially-developed Irvington binder that doesn't harden or lose its tack; that provides full assurance against migration . . . against delamination . . . against oozing out under heat. Thus Irv-O-Slot provides far greater service life, and far longer shelf life as well; and the thickness of the finished insulation is held within exact tolerance limits.

***Test Data:* The normal delamination test for slot insulation is 96 hours at 125°C. Laboratory tests show Irv-O-Slot withstands 150°C for over 288 hours, retaining full bond without migration.**

**Irv-O-Slot** is available in straight-cut or seamless bias varnished cambric bonded to either fish paper or rag stock. Write for generous test samples, further information.

*"Look to Irvington* **for Continued Leadership in Insulation"**

STANDARD OF THE WORLD IRVINGTON INSULATION TRADE REG. U.S. PAT. OFF. MARK

IRVINGTON

*Varnish & Insulator Company*

Irvington 11, New Jersey

FULLMAN Latrobe PRODUCTS

FLOOR BOXES ★ WIRING SPECIALTIES

FULLMAN MANUFACTURING CO. QUALITY AT LATROBE OUR SUPREMACY LATROBE, PA.

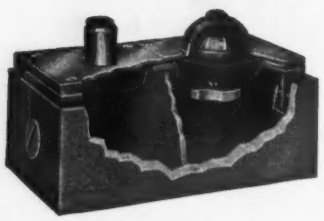
## "Latrobe" Products Save Time, Money, Labor

**Because "Latrobe" Products are speedily installed, give sure service and are built to endure, they offer great savings.**

**The only true economy lies in quality. In quality, "Latrobe" Products cannot be matched.**

**No. 110 "Latrobe" Watertight Box**

Simple and compact in design, the No. 110 Non-Adjustable Watertight Floor Box is quick to install and gives trouble-free service. Has No. 208 Receptacle. Cover Plate 3½" diam.

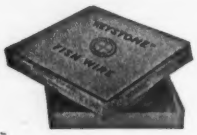


**No. 252-R "Latrobe" Two Gang Box**

Adjustable with No. 208 Receptacle in one section. One Cover Plate has ½" Flush Brass Plug; other has 2" Flush Brass Plug.

**No. 150 Box— No. 207 Nozzle**

Adjustable and watertight for installation in concrete or wood finished concrete floors. Underwriters approved.




**Keystone Fish Wire**

Made of high quality flat steel wire. Tempered exactly right. Ten sizes.

**NEW 1050 CABLE STAPLE for Romex and All Non-Metallic Covered Cable**

These new 1050 staples are 1¼" long by 9/16" wide. They are packed 100 per box, 500 per box, 2500 per carton, 10,000 per keg.

**"Bulldog" BX Cable Staples**

These high quality staples are packed in cartons, kegs or barrels. 2500, 6000, 30,000.

FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA

### Magnetic Relays (36)

Bulletin 110 multi-pole midget magnetic relays designed for general and special purpose control use has been developed. Standard two or three pole double throw relays have molded phenolic insulating bases, screw terminals for front connection and silver to silver contacts. Coils are available for operation on all standard voltages and frequencies up to 1115 volts a-c or d-c. Non-inductive ratings for n.o. and n.c. contacts are 10 amps. 24 volts d-c or 115 volts a-c 60 cycle. Typical applications include traffic signal, machine tool, alarm, heater and similar controls.

*Ward Leonard Electric Co., Mount Vernon, N. Y.*

### Wiring Trough (37)

An improved multiple wiring trough has been introduced. Used for multiple mounting of PAR 38 and R 40 lampholders, it incorporates side mounting in addition to bottom mounting. By placing one lamp in the side mounting hole the new arrangement makes it possible to mount eight lampholders in the ½-inch hole size.

*Stone Manufacturing Co., Elizabeth, N. J.*

### Electric Motors (38)

Announcement has been made of new electric motors, called "Fluid-Shaft", and featuring a single frame integral design of motor and fluid-drive coupling. Units utilize Reuland electric motor frames and end bells. They offer many advantages wherever loads require smooth acceleration, protection from "jamming" and shocks, or are difficult to start. Typical of these installations are conveyors, extractors, bridge and trolley drives on cranes, winders and mixers. Available in standard foot mounted, or round body frames. All units can be mounted horizontally or vertically, or with NEMA flange and face type end bells. Units are available in ½, ¾, 1, 1½, 2, 3, 5, 7½ and 10 hp.

*Reuland Electric Company, Alhambra, Calif.*

### Relay Tube (39)

A new miniature electron tube which will automatically turn an electrical current on and off 45 million times has been announced. Uses of the new tube, Type 5823, include control of flashing of animated electrical signs and intricate light systems of stock market quotation boards. Be-

cause tube consumes no standby electrical power and requires no warm-up period, it is especially suited for use in burglar alarms, remote-control devices, and complex automatic business machines. Tube is of the "cold-cathode, glow-discharge" type.

*Radio Corporation of America, Camden, N. J.*

### Safety Switch (40)

An all-new Type A safety switch, the HCI (High Capacity Interrupter) has been announced. Designed for use in modern high capacity industrial distribution systems, the switch has a new arc-quenching design and actuating mechanism, both of which give it ability to break unusually heavy loads quickly and safely. Arcs formed by double-break contacts repel each other and are driven against grid pins which cool and de-ionize them. Actuating mechanism provides positive quick-make, quick-break action by means of a roller-cam.

*Trumbull Electric Manufacturing Co., Plainville, Conn.*

### Roof De-Icing Kits (41)

A new roof de-icing kit has been designed to remove the householder's worries from ice and snow on the roof. It consists of 60 feet of lead sheathed heating cable complete with standard plug, shingle clamps for attaching cable to roof and installation instructions. The cable, looped around the edge of roof, melts channels through the ice, allowing water to drain away normally. Kit is rated 460 watts and is designed for operation from 110 to 120 volts power supply. One kit will protect from 18 to 20 feet of roof from ice dams.

*Rockbestos Products Corp., New Haven 6, Conn.*

# Product Briefs

(42) A new miniature current **indicator,** known as Mini-Amp., has been announced by Industrial Devices, Inc., Edgewater, N. J. . . . (43) A new automatic 8-inch **ventilating fan** has been developed for built-in installations by Shepler Manufacturing Co., Pittsburgh, Pa. . . . (44) A new line of totally-enclosed fly-wheel loom **motors** has been announced by General Electric Co., Schenectady, N. Y. . . . (45) A new **starter** for fluorescent lamps has been developed by Sylvania Electric Products, Inc., New York City, to operate either 85- or 100-watt lamps.

(46) A new collection of lead crystal chandeliers and accessory crystal **fixtures** has been introduced by Light-

(CONTINUED ON NEXT PAGE)

**NEW Wheelock CODE CALL FOR INSTANT COMMUNICATION**

Code call is made by a numerical code, sounding signals.

Signaling devices can be bells, chimes, horns, sounders, whistles and lamps.

Promptly completes telephone connections with organization personnel away from their own telephones.

Eliminates time waste of telephone operator and other employees in "man-finding."

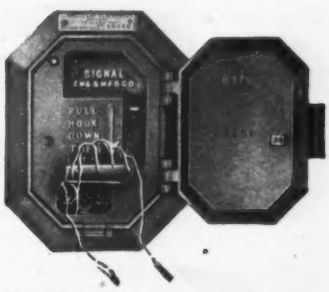
Enables employees without telephones to answer nearest telephone.

*Write for New Bulletin B4-3.*

## FIRE ALARM SYSTEMS (interior)

Several of the Wheelock achievements which are singular contributions to progress in interior fire alarm system manufacture are the engineering and development of the Alternating Current Fire Alarm System . . . the Solenoid Underdome Bell . . . the patented Automatic Master Code Fire Alarm System, and the patented March-Time Fire Alarm System (continuous ringing) with single stroke instead of vibrating bells or horns.

Systems fully supervised including coding contacts which give immediate notification of trouble that may occur on circuits.

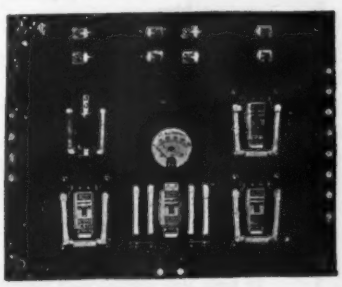


Coded, Pull Lever showing completion of downward pull.

Non Code, Break Glass (Hinged Hammer).

Available in two general types: NON CODE, and CODED Systems, with many possible modifications.

No. 3 Catalog upon request.



Typical Control Panel.

**SIGNAL ENGINEERING and MANUFACTURING COMPANY**

154 WEST 14th ST. • NEW YORK 11, N. Y.

# from many angles this General Electric Sportslight

## ...is lowest in Cost!

This is Sport's favorite floodlight. It won its spurs at Yankee Stadium. Since then it has been used to light more major-league parks, more minor-league parks, more college and high school stadiums, and more softball fields than any other floodlight of its type.

The reason? It does a superb job—the best, we believe, of any floodlight today—at a lower cost.

Use it in your floodlighting jobs. It's General Electric's Type L-69—available from stock from almost any General Electric sales outlet.

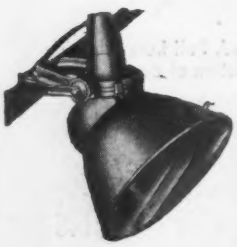
### LOWEST OPERATING COST

Extremely high-efficiency reflector design delivers roughly 10 per cent more light per watt—which means lower power bill for the same footcandles. And sealed construction and Alzak* processed aluminum reflector keeps original efficiency permanently high.

### LOWEST IN COST TO INSTALL

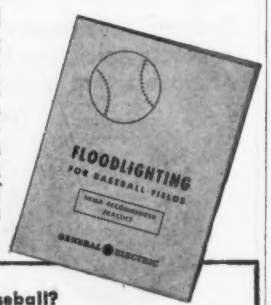
It has rifle-sight aiming. It can be properly positioned while being put up—during the daytime—saving nights of tedious adjustment. And assembly is simpler—no separate door glass to handle.

*Manufactured under Aluminum Company of America patents.



### LOWEST IN COST TO SERVICE

Relamping is done without disturbing reflector—and with one hand if necessary. Door glass (which is strong enough to take a direct blow by a ball) is spun-sealed to reflector, keeping out dirt, rain and bugs. No tools required for any servicing operation—even tilting for easy cleaning of front—and reflector always returns to its proper position.




**Planning an installation for softball . . . baseball?**

Engineers of General Electric's Illuminating Laboratory have prepared Standard Plans to help you get proper floodlighting at any level you desire. They're yours for the asking. GEA-2918 covers softball installations; GET-1373 covers baseball. See your nearest apparatus sales outlet or G-E Sales Office, or write *Apparatus Department, General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

451-136


olier, Inc., Jersey City, N. J. . . . (47) An improved line of Earthworm **boring machines** has been perfected by Lube Jack Company, Santa Monica, Calif. . . . (48) Photoswitch Incorporated, Cambridge, Mass. has announced a new high speed **photoelectric control,** for use in various inspection applications.

(49) Kato Engineering Company of Mankato, Minn., has announced a new series of **motor generator** sets. . . . (50) A new line of **welders** has been developed by Hobart Brothers Company, Troy, Ohio, called the "Bantam Champ" d-c arc welders. . . . (51) Cornish Wire Co., New York City, has developed a new all-neoprene **heater cord,** called "Coroprex".

(52) The "UCOM" **coupling** has been designed for use with thin wall conduit in combination with rigid conduit and with flexible steel conduit by using straight or angle connectors, by Midwest Electric Mfg. Co., Chicago. . . . (53) J. H. Williams & Co., Buffalo, N. Y., has announced a new **aluminum pipe wrench.** . . . (54) High current dual **rectifier elements** measuring 7¼ in. by 12¾ in. have been developed by the International Rectifier Corporation, Los Angeles, Calif.

(55) Portable Electric Tools, Inc., Chicago, is offering a new **portable polishing and sanding kit** for electric drills. . . . (56) Suclar Laboratories, Inc., Newark, N. J., has developed new automatic Noblink **starters** for fluorescent lamps. . . . (57) A new totally enclosed, fan cooled **motor** is being manufactured by Valley Electric Corporation, St. Louis, Mo.

(58) Jefferson Electric Company, Bellwood, Ill., has announced a new line of hanging-type **transformers** for window Neon signs. . . . (59) A new 200 ampere a-c industrial type **welder** has been announced by Lincoln Electric Company, Cleveland, Ohio. . . . (60) Beaver Pipe Tools, Inc., Warren, Ohio, are manufacturing a special quick opening **diehead** designed specifically for use with all electric power drives.

(61) Transvision, Inc., New Rochelle, N. Y., announces a master **amplified antenna system** for apartment houses, hotels, hospitals, etc. . . . (62) Hydraulic **dynamometer** SA-484 of 30 to 300 foot pounds capacity for load testing large electric motors is manufactured by Wagner Electric Corporation, St. Louis. . . . (63) A new portable, hand operated **cable cutter** has been introduced by Beverly Shear Mfg. Co., Chicago, Ill.

(64) The pocket size "Besjet" automatic **blow torch** has been announced by Emil Greiner Company, New York City. . . . (65) New sectional **terminal blocks** of the single-circuit type, which can be assembled into strips of any

length from one to 75 pairs of terminals, are available from Westinghouse Electric Corp. . . . (66) A new electrically heated **cable and insulation unit** to prevent water pipes from freezing has been announced by Gro-Quick Co., Chicago, Ill.

(67) United States Rubber Company, New York City, has announced the addition of round endless **belts** to its U. S. Rainbow line. . . . (68) A new high voltage air break **contactor,** Type 256, has been developed by Allis-Chalmers Manufacturing Co., Milwaukee, Wis. . . . (69) Cordomatic Division of Vacuum Cleaner Corp., Philadelphia, has announced a new **trouble-lite reel.**

(70) A new plastic **spacer** has been developed for use with Transite Kord-uct, asbestos-cement conduit made by Johns-Manville, New York City. . . . (71) Positive locking, exact nut adjustment, speed of application are some of the features of the new **locknut** being manufactured by Security Locknut Corporation, Chicago, Ill. . . . (72) Industrial Electronics and Transformer Company of Los Angeles has designed a **selenium rectifier** cathodic protection unit.

(73) Westinghouse Electric Corp., Pittsburgh, Pa., has developed a new **handle mechanism** for circuit breaker and control cabinets. . . . (74) Announcement has been made by Allis-Chalmers, Milwaukee, Wis., of the Ruptair **replacement unit,** which is specially adapted for replacing obsolete oil circuit breakers. . . . (75) Walter Kidde & Company, New York City, has developed a multi-space **smoke detector** for general and industrial use.

(76) Handy Industries, Chicago, Ill., has announced a new **screw-holder** for hard-to-get-at spots. . . . (77) All-State Welding Alloys, Inc., White Plains, N. Y., has introduced a new line of packaged **brazing alloys** for service trades. . . . (78) A new ceiling **lighting fixture,** designed by Homecraft Electronic Products, Chicago, features three Circlarc 18 watt bulbs.

(79) A new **carbon-graphite material** for bearings has been developed by the Pure Carbon Co., St. Mary's, Pa. . . . (80) Dryomatic Corporation of America, Baltimore, Md., has announced a new **dehumidifier** for both domestic and light commercial use. . . . (81) A new line of **welders,** known as "Bantam Champ" d-c arc welders has been developed by the Hobart Brothers Company, Troy, Ohio.

(82) The Lange Company, Milwaukee, has introduced a new "Mobil-Draulic" **lift,** which is a combination hydraulic elevator and hand operated four wheel truck. . . . (83) A new **induction heating unit** has been announced by the High Frequency Heating Division, Lindberg Engineering Co., Chicago, Ill. . . . (84) A new lever **switch** for low power application has been announced by Switchcraft, Inc., Chicago, Ill.

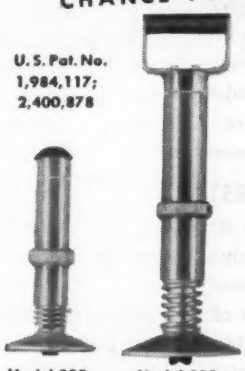

from CONNECTICUT TO TEXAS in record time!

THEY DID IT with the help of DRIVE-IT

the safe, modern fastening system!

CHANCE VOUGHT AIRCRAFT PLANT • DALLAS, TEXAS

U. S. Pat. No. 1,984,117; 2,400,878



Model 222 for light fastening

Model 238 for heavy fastening

● When the Chance Vought Aircraft Plant was moved from Connecticut to Dallas, Texas, it had to be done with a minimum of production interruption. That meant speed was imperative in building the new plant.

The C. Wallace Plumbing Co. of Dallas chose DRIVE-IT as the fastest, least expensive and most efficient method to fasten over *400 tons* of air conditioning duct to concrete. "Only through the use of DRIVE-IT", said the contractor, "were we able to keep ahead of the fabrication crews and get the job done in record time."

This is a typical experience of hundreds of contractors who rely upon powder-powered DRIVE-IT—teamed with the right drive pins—to do their steel-to-concrete fastening jobs.

Write today for the whole story and the name of your nearest DRIVE-IT distributor.

DO IT WITH DRIVE-IT! and save hours and dollars on your Fastening Jobs!

- Anchoring metal lath and ceiling framework
- Installing metal partitions and flooring.
- Hanging air conditioning and sprinkling systems.
- Anchoring electrical junction boxes and conduits.
- Maintenance jobs involving fastening metal objects to walls, floors and ceilings.

*Distributors Coast-to-Coast*

*Canadian Distributor:* AMMO-POWER TOOL CO., LTD., Ft. of McLean Drive, Vancouver, B. C.

POWDER-POWER TOOL CORPORATION
0702 S. W. Woods St. Portland 1, Oregon

DRIVE-IT
THE MODERN MIRACLE TOOL

Why use ordinary low price lugs when you can now use superior Frankel *Flexilugs at no extra cost?* For over 10 years the choice when high quality and unexcelled performance were required, Frankel *Flexilugs* are now priced so low that you can use them for every lug requirement!

Sturdier than ever, the new Frankel *Flexilug* is now entirely cadmium plated to prevent corrosion and to enable use with aluminum and steel cables. Patented interlocked construction keeps *Flexilug* parts always together . . . no parts to work loose or drop out. Increased contact surfaces give 100% conductivity. Five sizes take all wires from 500 mcm stranded through #14 solid. Equally dependable for stranded, flexible or solid wire.

Get tough jobs done faster, easier with Frankel *Flexilugs*!

●

Write today for new price list and compare Frankel *Flexilug* value! SOLD THROUGH LEADING WHOLESALERS ONLY.

FRANKEL
CONNECTOR CO.
27 VESTRY STREET • NEW YORK 13, N. Y.

42 Years of Know-How in Solderless Connector


# Catalogs, Bulletins and Engineering Data

(85) MANUAL STARTERS to provide overload protection for motors of 1-hp. or less are subject of 4-page folder 1199. The Trumbull Electric Manufacturing Co.

(86) CATALOG with prices on adapters, hangers, boxes, clamps, connectors, covers, elbows, locknuts, etc., is available. J. R. Richards Co.

(87) DIRECTIONAL SIGNS, combining edge lighting, surface and recessed exit boxes are illustrated and priced in folio E49. Gruber Brothers, Inc.

(88) SWITCHBOARDS and special power control equipment is presented in loose leaf form in 11-page catalog PL-100. Taller and Cooper, Inc.

(89) ACCENT LIGHTING by means of 150w R-40 and PAR-38 as well as 75w R-30 spot and flood lamps in conjunction with hi-hats, rotobeams, fresnel lenses, recessed adjustable units and newly designed aluminum housings is subject of catalog 649 and 8-page bulletin "New Designs in Accentlights". General Lighting Co., Inc.

(90) POTHEADS for cable end protection are described with text and drawings, with installation techniques explained in bulletin DIP. G & W Electric Specialty Co.

(91) INSULATION construction is dramatically presented in booklet containing full-color cut-away plastic pages showing outer braid, asbestos insulating wall, varnished cambric tapes and paper tapes. Rockbestos Products Corp.

(92) AIR CONDITIONERS for wide variety of applications are described in series of bulletins, PM79-0101, PM79-0201, PM79-0301 and PM79-0401. These packaged units are recommended for homes, offices, schools, stores, restaurants, etc. General Electric Co.

(93) MOBILIERS with wide selection of designs incorporating louvers, glass panels, recessed and suspended housings, 2 and 4-lamp fluorescent assemblies are subject of catalog. Mobilite, Inc.

(94) FLAME FAILURE in combination gas-oil burners is prevented by safeguards described in bulletins CG 4751 and CH 4753. Combustion Control Corp.

(95) CABLE SPLICING kits for making 2-way joints are described in bulletin CJ5. G & W Electric Specialty Co.

(96) DYNAPRENE flexible cords of 300- and 600-volt ratings, sizes 18 to 10 AWG with amperages from 7 to 20 are discussed in 2-color 4-page folder. The Whitney Blake Co.

(97) SHOW CASE, commercial and industrial lighting fixtures are sketched, described and dimensioned in catalog 949. Artcraft Fluorescent Corp.

(98) TV ANTENNA systems for multiple-receiver use are specified, diagrammed and priced in catalog 149. Jerrold Electronics Corp.

(99) RELAYS, temperature controls and thermometers, with specifications, prices and description are subject of 16-page catalog, number 14. H-B Instrument Co.

(100) TRANSFORMERS for indoor use, with ampere ratings from 5 to 800, are pictured, dimensioned and priced in bulletin 124. R. E. Uptegraff Manufacturing Co.

(101) OIL CIRCUIT BREAKERS for central station and industrial service where breakers are rated 2000 amps. or less and interrupting capacities are between 15kv and 500,000kva are discussed in bulletin 71B6129D. Allis-Chalmers.

(102) COMMERCIAL ILLUMINATION using fluorescent and incandescent components, having glass and metal louver panels, recessed, surface mounted and suspended, are described in catalog CO49. Globe Lighting Products Co.

(103) VOLT-AMP-WATT meters designed for portable testing of a-c circuits, measuring volts, ohms, amperes, milliamps., microamps., decibels and output volts in multiple ranges are described in 2-color file sheet. The Hickok Electrical Instrument Co.

(CONTINUED ON PAGE 178)

In the last 12 months alone, 43,771,720 people have seen Lightolier advertising in Life, Better Homes & Gardens, House & Garden, House Beautiful, the New York Times Magazine, the New Yorker and other publications—the biggest campaign in lighting history. They know that "It's a Lightolier" stands for style and quality in every type of lighting equipment.

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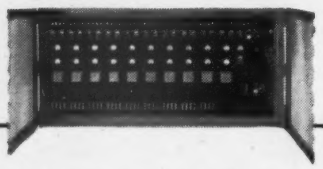

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*quickly, easily and safely!*

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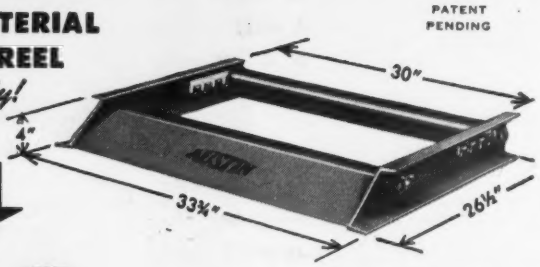

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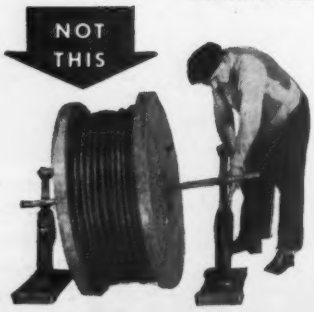
MAXIMUM CAPACITY: 4000 LBS. WEIGHT: 75 LBS. EACH

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are described in 2-color file sheet. The Hickok Electrical Instrument Co.

(104) ALARM SILENCER designed for use with motors, transformers, boilers, furnaces and tanks is subject of bulletin 7400. Automatic Control Co.

(105) BALLASTS for fluorescent lamps are specified, sketched and discussed with wiring diagrams in catalog 449-FL. Jefferson Electric Co.

(106) SELENIUM self-generating photo-electric cells are described with diagrams, curves and text in bulletin PC649. International Rectifier Corp.

(107) WELDING HOSE, red for gas, green for oxygen, made from rubber, special braids and webbing, are subject of bulletin 4200. B. F. Goodrich.

(108) CONNECTORS for installations involving vibration, such as oil burner assembly, are promoted in 2-color pocket-sized pamphlet. Unimatic Corp.

(109) SELLING MANUAL for lighting fixture distributors, including showroom blueprints and promotional hints, covers 150 pages. Lightolier, Inc.

(110) SAFETY catalog of personal protective equipment and industrial devices, covering first aid, nose and eye protection, clothing and miscellaneous items is available on request. E. D. Bullard Co.

(111) DRY TYPE air-cooled transformers are presented with weights, dimensions and full technical data in bulletin S202A. Standard Transformer Co.

(112) DOOR OPERATOR, designed for doors weighing up to 750 pounds and controlled by any of 10 different means, is described on file sheet, Form SM, Robot Appliances, Inc.

(113) CONNECTOR bulletin LS4-1248 includes 12 standard fittings rated at 75 amps. for use in laboratories and on switchboards. Cannon Electric Development Co.

(114) BELTING catalog contains detailed designs, engineering and performance data, belt speeds, arc of contact, friction, horsepower corrections and service factors. United States Rubber Co.

(115) ARC WELDING accessory catalog, GEC-253A, contains descriptions, specifications and prices of more than 150 products such as electrode holders, electrodes, protective clothing and aids, connectors, tools and ground clamps. General Electric Co.

(116) VERTICAL LIFT BREAKERS with horizontal contact separation are subject of bulletin 18B7094. Allis-Chalmers.

(117) TONG METER, pocket sized, for split-core volt-ampere measurement, is described in catalog 109. Pyramid Instrument Co.

(118) TAPES, friction and rubber, are presented with specifications in 2-color 3-fold file folio. Accurate Manufacturing Co.

(119) INCANDESCENT lighting units, square and recessed for store and commercial applications, are described in bulletin SR849. Litecraft Manufacturing Co.

(120) PIPE TOOLS catalog 49 lists line of hand and power tools for cutting and threading pipe, bolts and conduit. Beaver Pipe Tools, Inc.

(121) BATTERY CHARGER, 4 circuit, for servicing industrial trucks is specified, pictured and discussed in bulletin 235. The Electric Products Co.

(122) FARM AND HOME electrical products are presented in 35 page catalog (B-4042) designed for selling rural market such equipment as motors, controls, lighting, wiring, heating and appliances. Westinghouse Elec. Corp.

(123) FLUORESCENT FIXTURE catalog, divided into industrial, commercial-residential and troffer sections, covers complete line of lighting units. Sylvania Electric Products, Inc.

(124) PUSHBUTTON control with automatic protection for electric circuits is subject of 24-page 2-color bulletin 493-1 explaining simple design and interchangeability of Pushmatic units. BullDog Electric Products Co.

(125) LARGE D-C MOTORS and controls for heavy duty drives are discussed and illustrated in 40-page 2-color bulletin 05B6002A. Allis-Chalmers.

(126) PHOTOELECTRIC controls are discussed in bulletin PD 476. Photoswitch, Inc.

(127) GENERATORS, motors and controls are discussed in series of 6 catalog-insert bulletins numbered 100, 500, 501, 502, 510 and 671. Ideal Electric and Manufacturing Co.

(128) VARNISHED TUBING products and saturated sleevings with an easy-to-read selection chart are presented in technical folder. Insulation Manufacturers Corp.


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*because--*

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QUAD FACTS . . . the QUAD line of sign lighting reflectors includes a total of fifteen different sizes and shapes ranging from six inch round for 40 watt lamps to eighteen inch rectangular for 1500 watt lamps. Whether the job is large or small there is a QUAD reflector that fits.

All are finished in permanent porcelain enamel—green outside with a lustrous white inside reflecting surface. Fittings are thoroughly rustproof.

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Designed for small and medium sized signs this unique one-piece reflector is ideal for store-front transoms. Streamlined, yet inconspicuous, it does not obstruct view of sign. Rust-proof, weatherproof, easy to wire, it mounts on a shorter ½" pipe arm. Light distribution is wide on the sign with straight line cutoff at upper edge.

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Widely used for wall signs and bulletin boards, these reflectors produce a uniform distribution of light over a wide vertical area. The contour is such that a straight line cutoff of light at the top of sign is obtained without spillage, scallops, or shadows. Sizes range from 50 Watts to 1500 Watts.

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Generally used for gasoline station advertising, these efficient reflectors are in service everywhere—lighting all kinds of signs from "Tourist Rooms" to full sized bulletins. The forty-five degree axis of light distribution insures proper lighting at the bottom of the sign. Sizes range from 40 Watts to 500 Watts.

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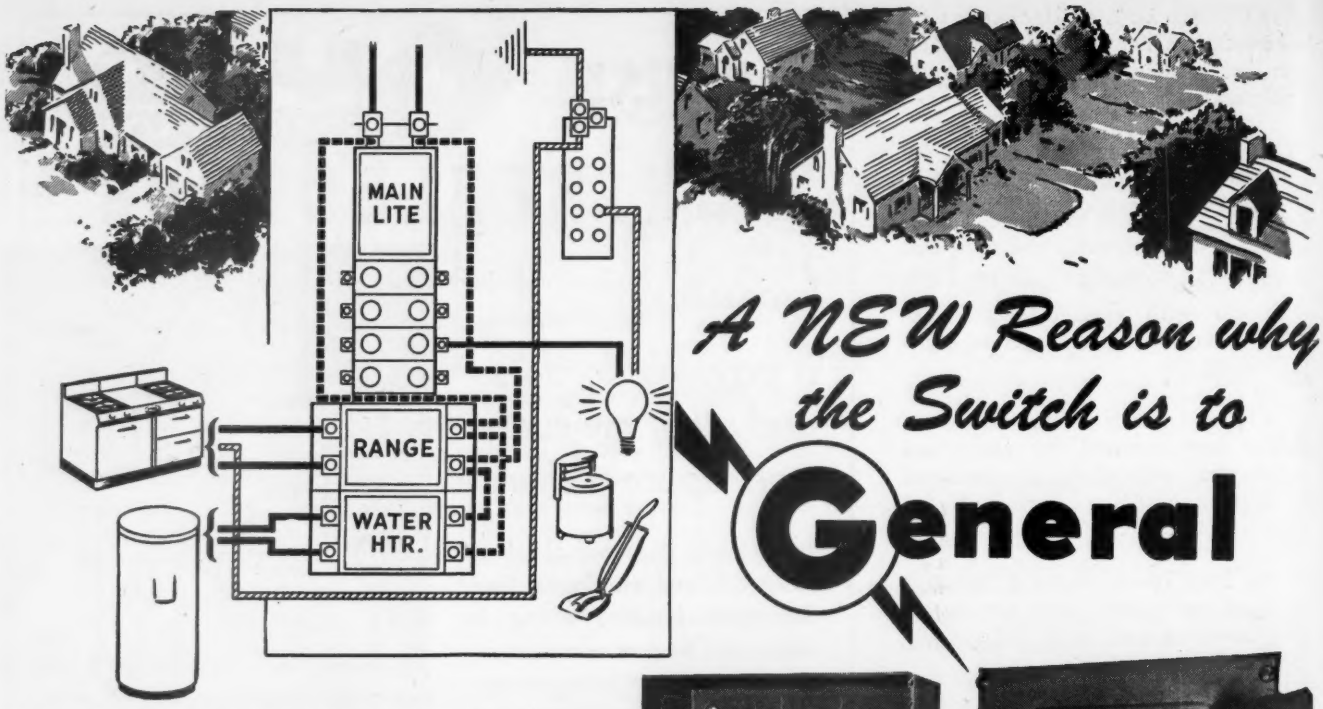


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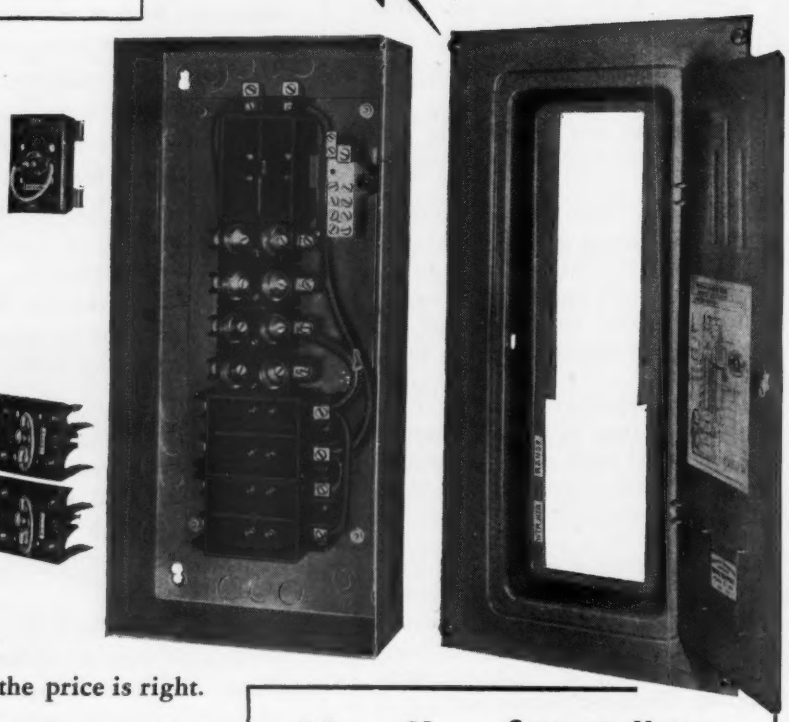


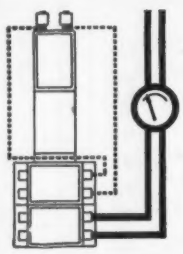
**General Switch Cat. No. 663-108, Main-Range-Water Heater Combination Triple Pullout Unit**

100 Amp main lugs feed the 60 Amp pull-out switch controlling from 4 to as many as 12 plug fused lighting circuits. The main lugs also feed the Range and Water Heater pullout switches . . . available in 30 or 60 Amp and non-interchangeable to prevent overfusing. Flush or Surface. Underwriter Laboratories approved.

THE new GENERAL Main-Range-Water Heater Combination Triple Pullout Unit, the latest addition to the GENERAL SWITCH extensive line of enclosed switches and panels, means a real saving in time and materials, is a neat, compact unit, is thoroughly dependable and . . . the price is right.

The development of this all-in-one unit is another step forward in the GENERAL SWITCH planned program of product development of "unitized" equipment for simplified electrical systems at lower cost.

Save time and save money . . . investigate this new unit and *Switch to* GENERAL *today*! Available everywhere exclusively through wholesalers.

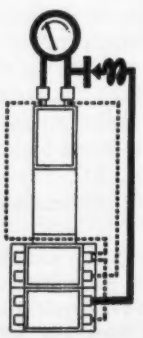


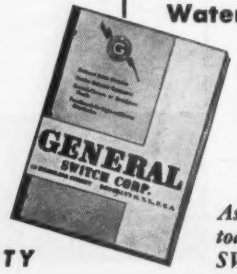
**Separate Meter for Water Heater**

Simply remove jumpers and feed the water heater pullout switch through separate meter.

**Carrier Relay or Time Clock Water Heater Disconnect**

Remove one jumper and connect water heater switch through disconnect element of meter.



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**49 Roebling Street** **Brooklyn 11, N. Y.**

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F. N. M. SQUIRES
*Chief Inspector*
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# Questions on the Code

## The Neutral Conductor

**Q.** *On page 30 of Abbott's Code Handbook, I would like to know whether I understand Section 314 correctly. My understanding is that in a 120-208 volt, 3phase, 4 wire system, the three hot conductors need not have a correction factor applied because of the presence of a neutral wire in the same conduit. Specifically, if I were to run three No. 2 hot lines and one No. 2 type T conductor in a 2 inch conduit, I am assuming it would be capable of carrying 95 amperes and not 76 amperes as when a correction factor is applied.*—K.O.

**A.** Note 5 following Tables 1 and 2 of the National Electrical Code supplies the answer to this question.

What Note 5 means is that on this 3 phase 4 wire system mentioned above, the wires are not derated because of the presence of the neutral conductor. In other words do not count the neutral.

Therefore, not more than three No. 2 type T conductors together with a neutral wire have a carrying capacity of 95 amps.—F.N.M.S.

## Farm Wiring

**Q.** *I have wired a considerable number of farms in Iowa and just recently I moved into South Dakota as the R.E.A. work there was getting under way. For several years I have run underground to the yard light pole with underground wire to a small junction box on the pole and then from the box to the yard light fixture with two wire service entrance cable. The inspector on the project here refuses to accept this type of cable and says that conduit or tubing must be used. Does the Code require that now?*—R.K.P.

**A.** No. The N. E. Code will accept service entrance cable on a pole provided it is properly supported. However, on many R.E.A. projects you will find local rules prohibiting the use of cable of any type on poles because of adverse experience. The story behind this ruling on many R.E.A. projects is that the lineman's spurs will cause trouble and possibly injury when working on poles to which service cables are fastened. —G.R.

## Feeder Circuit

**Q.** *A year or so ago we wired a paper products plant where fancy wrapping paper and stickers were produced. One set of feeders were run across the ceiling of a fair size room which contained a long drying oven. At that time we discussed the problem with the owner and inspector and were told the temperature of the room would never exceed 105 or 110 because of the amount of air being exhausted, so we used Type RH wire knowing that it was good for temperatures far above 110 degrees.*

*Last week we were called back because of trouble and found this feeder circuit had faulted and burned a good size hole in the thin wall. Upon checking the load we found it had not been increased as it amounted to some 62 amperes of noninductive load on No. 6 RH conductors. Now the inspector claims we will have to use asbestos insulated wire. We believe the wire was defective but before pulling in more Type RH we will appreciate your suggestions on this.*—M.L.

**A.** If the room temperature reached 110 degrees in the room with the oven, the ceiling temperature undoubtedly was much higher. The actual temperature should be determined before deciding on the insulation which should be used. However, if the temperature were only 110 degrees and three No. 6 Type RH conductors were carrying 62 amperes the original installation was a Code violation. Section 3102-a states that no conductor shall be used under such conditions that its temperature even when carrying current will exceed the temperature specified in the table for the type of insulation involved.

Table No. 1 shows that a No. 6 Type RH conductor carrying 62 amperes will be operating very near its maximum limits if the room temperature is not more than 86 degrees. Therefore the correction factor table should have been referred to as that would have indicated a No. 6 RH conductor would be limited to 65 times about 84% or 55 amperes if the room temperature was 110 degrees. Therefore a No. 4 Type RH conductor could have carried the load of 62 amperes in an ambient temperature of 110 without exceeding the maximum temperature limitations as set forth in Table No. 1.—G.R.

## Difficulties of A Local Ordinance

**Q.** *We have a question for you which is not National Code, but is a local ordinance. Our rule number 207 is as follows:*

"Bare neutrals will be permitted on service-entrance conductors (for other than 3 phase 3 wire) from the service head to and including switch and trough or gutter at the first distribution center inside or outside the building walls."

*In wiring a single story duplex apartment building we are required to place a raintight type switch below the meter socket, then in conduit to the distribution center 25 or 30 feet within the building. We have been using a bare neutral from raintight switch to multibreaker panel within the building. Our local inspector claims that the first switch is the distribution center and that we have to install an insulated neutral from this switch to the multibreaker panel. We would very much appreciate your interpretation of what constitutes the first distribution center.* —F.O.D.

**A.** For an official interpretation of a rule of your local ordinance,

# FAST — ECONOMICAL

Drilling — Cutting and Chipping
in Concrete and Masonry

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SYNTRON

DEPENDABLE

# ELECTRIC HAMMERS

Electromagnetic design—no motors, gears, cams, eccentrics. Only One Working Part—the Piston.

3600 powerful blows per minute from one working part — the piston — speed up the drilling of anchor bolt holes, cutting, chipping and channelling for conduit.

Operate from ordinary 110 volt AC lighting current.

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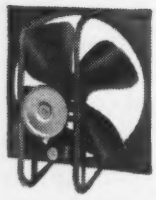

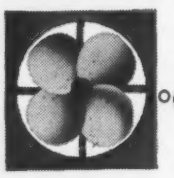

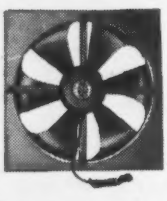

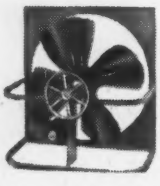

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And "FRIGID" has the complete line of ventilating equipment to meet the needs and demands of these companies . . . exhaust fans, blowers, spray booth fans, attic fans, etc. . . .

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you should appeal to those who wrote the rule into the ordinance; they are the only ones who know what the intent was, and is.

In general, however, a raintight service switch outside the building is not one with which is incorporated the branch circuit protective devices and a distribution center is generally a panel from which branch circuits originate.

Under the National Electrical Code Rules, the bare neutral service wire would not be permitted to extend on the house side of the service switch.

If the service switch is inside of the house, it would have to be near the point of entrance of the wires into the building and not 25 or 30 feet within the building.—F.N.M.S.

## Ranges

**Q.** *Each time the subject of ranges, rated at more than 12 kw. but not more than 21 kw., is brought up, an argument ensues.*

*The Code Book is quite ambiguous as to what to take 5% of. Upon first reading the footnote of Table 29, it seems that the intention is to take 5% of the kw. exceeding 12 and add it to the maximum demand. If this were done on a 16 kw. range, the actual added current to wire for, would be less than one amp. and as apartment houses usually use smaller ranges than an 8 kw. it does not seem that this footnote was added to take care of a number of these ranges. If the intention to take 5% of the 16 kw. and multiply that by the 4 kw. which the range exceeds 12, and then add that to the maximum demand set aside in Column A we get a more logical answer and one which goes along better with the maximum demand required by the 1940 code.*

*Will you please tell us the correct way to figure the demand on such ranges?*—J.E.B.

**A.** Table 29 with its footnote 1, governs range installations. For a single 16 kw. range, 5% of 4 kw. which is the excess of a 16 kw. over the 12 kw. one, is added to the 8 kw. given in Column A of Table 29, therefore the demand of a 16 kw. range is 8.2 kw.

For two 16 kw. ranges on the same feeder, the demand over a 12 kw. range is 11 kw. and the excess of two 16 kw. ranges or 32 kw. over 11, is 21 kw. of which we take 5% or 1.05 kw., adding this to the 11 kw. in Column A gives us a total demand for two 16 kw. ranges, of 12.05 kw. More ranges on the same circuit are figured similarly. For 8 kw. ranges use Column C.—F.N.M.S.

## Standby Plant

**Q.** *A small chicken hatchery out in the country bought a 15 kw. light plant for standby use in case of outage of their present source and I was asked to connect it up for them. They are on a three phase line now and their standby plant is three phase, so I used a three pole double throw switch and arranged a bell on a holding coil so the bell will sound should the high line power fail. Then the switch can be thrown to the opposite position and the generator started. Shortly after completing the job the R.E.A. manager told the owner that he could not permit such an installation on his lines. What might be wrong with such a plan?*—A.N.S.

**A.** While this is not a Code question, it is probably of sufficient interest to be included in this column. Where standby electric generating plants are used on premises normally supplied by utility distribution lines the double throw switch must break all conductors including the neutral. Therefore you should have used a four pole switch.

They are justified in requiring that all conductors, including the neutral, be switched because of the possibility of unbalance of current being present on a supposedly dead distribution line. This condition has actually occurred in at least one instance, so I have been advised.—G.R.

## Overcurrent Protection

**Q.** *A rather large store building is being erected here and the other day I noticed that the distribution panels were all equipped with 20 ampere breakers and the electrician claimed that it was all right as they were using No. 12 wire for all the circuits. Has the Code been changed?* —E.B.M.

**A.** No. The Code has not been changed. All circuits supplying convenience outlets or medium base lamp holders must be protected by overcurrent devices having a rating of not more than 15 amperes. This rule is found in Section 2123 of the N. E. Code. Here you will find that only heavy duty type lampholders may be connected to 20 ampere circuits with an exception being made only for medium base lampholders of the porcelain unswitched type and for fluorescent lampholders when only fixed lighting units are supplied. In a store building it might be possible for one

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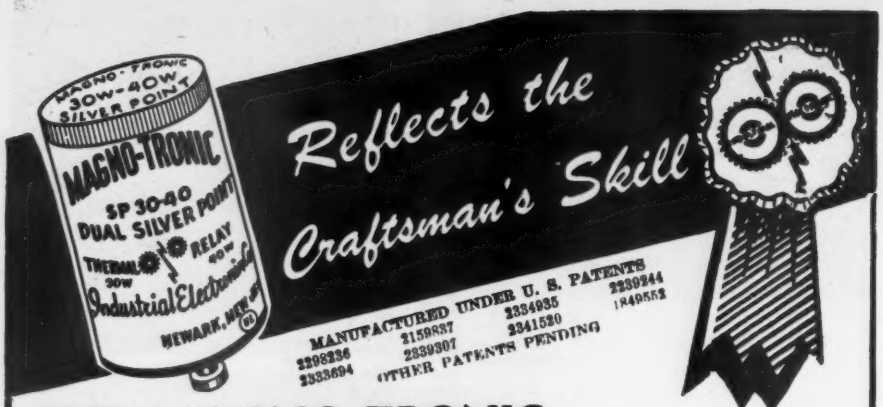


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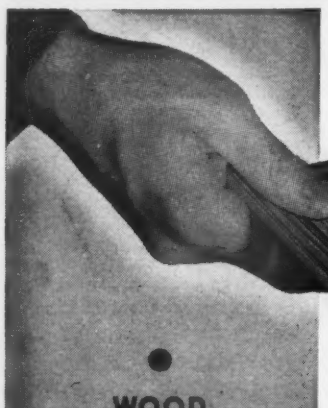

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entire distribution panel to supply only fluorescent lamp circuits and in such a case it would be proper to provide 20 ampere overcurrent protection on No. 12 conductor circuits.—G.R.

## Fluorescent Fixtures

**Q.** *The service in a building was changed from d-c to a-c. The electrician who did this work for the building left the tenants under the impression that they could use their present d-c fluorescent fixtures on a-c current. We have since made two changes in the building removing the old fixtures and rewiring them with a-c ballasts. We know from past experience that using a d-c fixture on a-c is not efficient.*

*We would like a ruling from you whether you would pass these d-c fixtures at random not knowing what the construction is and how old they are.—M.A.E.*

**A.** In general, d-c fluorescent fixtures will not operate successfully on a-c. While some d-c fluorescent fixtures, in the smaller tube sizes of 20 watts or less, may operate on a-c others do not operate satisfactorily, some do not start and some present certain fire hazards.

Fluorescent fixtures, unless they bear labels of Underwriters Laboratories, and are marked for a-c, should not be used on a-c circuits. Therefore, any old fixtures which have been installed for use on d-c, should be carefully checked before being connected to alternating current circuits.—F.N.M.S.

## Switches for Cooling Units

**Q.** *We are planning to install individual cooling units in some fourplexes being erected here. These units are powered with ¾ hp. motors and have an integral switch on the cabinet for control of the unit. May we provide four separate switches in the basement of this building adjacent to the service equipment as disconnecting switches for the circuits supplying each cooler?*—E.M.P.

**A.** No. The Code will not permit these switches to be located in the basement. Section 4241-b states that for stationary appliances of more than 300 volt-amperes or more than ⅛ horsepower the branch circuit switch or circuit breaker may, if readily ac-

cessible to the user of the appliance, serve as the disconnecting means.

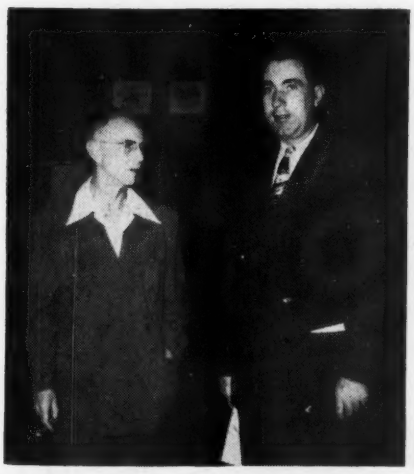
Then under 4241-c we find the following ruling: "Switches which are part of an appliance shall not be considered as taking the place of the single disconnecting means required by this section unless there are other means for disconnecting as follows: In multi-family dwellings (more than two) the disconnecting means shall be within the apartment, or on the same floor as the apartment in which the appliance is installed, and may control lamps and other appliances." Therefore feeders will have to be run to each floor and the disconnects will have to be either in the common hallway or in the individual apartments. —G.R.

## Grounding

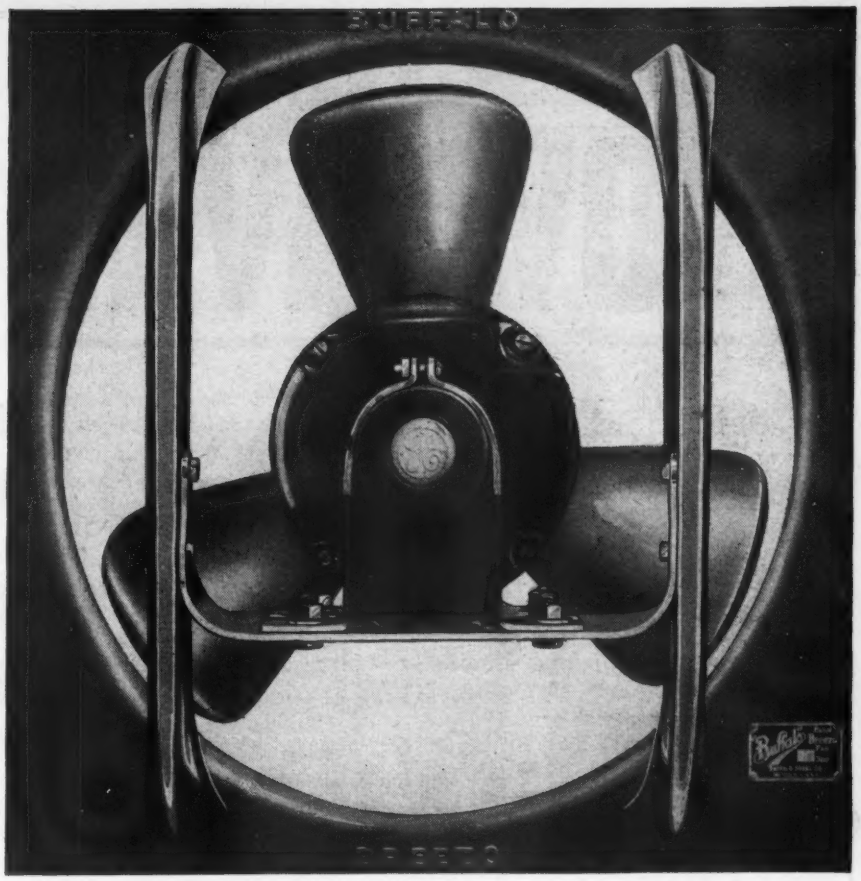
**Q.** *According to Section 1975, a green colored wire is to be used for equipment grounding when flexible cords are used. Which color would be used in a 3 wire cord consisting of black, white and red colored wires?—A.H.R.*

**A.** Section 2559 requires that if a grounding conductor used for grounding portable equipment is in a cable assembly or flexible cord, it shall be finished to show a green color.

In case it is necessary to use a cord with black, white and red colored wires, the red one could be painted green at the ends.—F.N.M.S.



***Electrical contractor Paul A. Hoyte of Hoyte Electrical Service, Brighton, Mass. (left) talks about electrical installation problems with Jefferson Electric Co's. representative John J. Brogan, Wellesley, Mass., at the August Annual Meeting of the Eastern Section, International Association of Electrical Inspectors, held at Hotel Statler, Boston.***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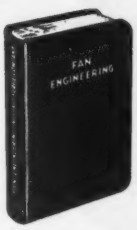


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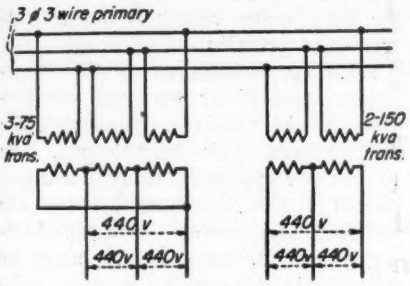
# Reader's Quiz

## Transformers in Parallel

*QUESTION 325—I would like to know if any of your readers can tell me whether or not the 440 volt secondaries of the following diagram can be satisfactorily paralleled? Will any harmful circulating current flow? Will the voltage of each secondary be in phase?*—A.F.D.

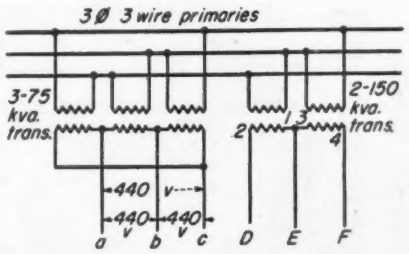



A. TO QUESTION 325—Under no circumstances should an open delta transformer bank be paralleled up with a closed delta. It would be far better to parallel two open delta banks, but even then, great care must be exercised.

Transformers of different ratings should never be paralleled. There is no guarantee that the load will divide between the transformers in the ratio of their ratings, and it is quite possible for the smaller rating unit to take most of the load and the larger rating to be relatively unloaded. Before paralleling transformers a careful study must be made of the regulation and of the reactance of each transformer to be sure of the division of the load under any circumstances.

In the case under discussion, the third transformer closing the delta in the 75 kva. bank will attempt to supply the balancing current for the open delta bank and will most certainly be overloaded and will burn out.—H.H.S.

A. TO QUESTION 325—A can be connected to d, B can be connected to E and c can be connected to F, provided all primaries are wound in the same direction and all secondaries wound in the same direction. In order to determine whether this is so, first connect a to D and measure the voltage between b and E and also the voltage between c and F. If they both measure about zero, they can be paralleled. Since there is a possibility of getting 880 volts between b and E and also 880 volts between c and F, it would be advisable to make the tests with reduced voltage on the primary to get safer secondary voltages or else to use great caution. If it measures 880 volts, *Leads 1 and 2 should be interchanged and *Leads 3 and 4 should be interchanged, and the tests repeated if the voltages between b and E and c and F then found to be zero they can be paralleled. At no load there should be no circulating current if the tests were properly made and changes made if found necessary. At other loads the nearer together the transformers or the lower the impedance of the conductors connecting the transformers together, the greater the possibility of circulating current. Also, the greater the possibility of circulating current. If the voltage regulation

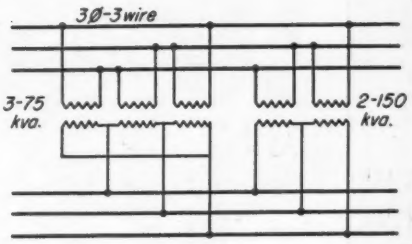



of the two transformer groups are different. Of course, all transformers should have the same voltage ratio and same voltage rating.

* *Refers to leads coming out of transformers only. Do not change D, E and F—leave them as they are.*—E.B.

A. TO QUESTION 325—Completing your diagram to the extent of connecting the transformer secondaries for clarity—I would say that the diagram of the two banks of transformers, connected respectively Delta to Delta and Open Delta could satisfactorily be paralled.

This is assuming of course, that the polarities were the same. You did not indicate that they differed. If they did differ, it would only be necessary to




reverse either the primary or secondary of the open delta bank.

The two open delta connected transformers will give a net working capacity of 86.5% of their combined rating—so the capacity is adequate.

The regulation of any open delta connected bank is not too good and is different for the different phases. For most efficient operation, the reactance of each transformer should be small.

In distribution work, we resort to open delta frequently.—E.A.M.

A. TO QUESTION 325—The proposed connection would result in two sides of the delta being each composed of unlike transformers in parallel. The third side of the connection would have a still different rating.

Transformers cannot be placed in parallel indiscriminately. Due to design factors, accidental or otherwise, circulating currents are apt to flow which may materially reduce the available output of the transformers. These circulating currents do not appear in the external circuit, so are generally not detected and often are not suspected. The circulating currents are of the magnitude

$$I = \frac{e}{Z_1 + Z_2}$$

where

$I$ = circulating current
$e$ = voltage difference inside circuit
$Z_1$ = equivalent impedance of one transformer
$Z_2$ = equivalent impedance of other transformer

The various factors will be considered in turn.

*1. Polarity.* The secondary voltages of the two transformers in parallel must be in phase. To test: the middle wires of the secondaries, as shown in the diagram furnished with the ques-

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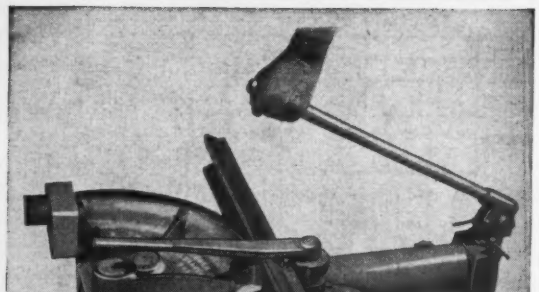

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tion, are solidly connected. Then a voltage reading is taken between the two left-hand wires and between the two right-hand leads. If either of these two voltages is in the neighborhood of twice the transformer secondary voltage, the respective secondary voltages of the two banks are in opposition. The solution would be to reverse the secondary connection of BOTH of the 150 kva. transformers.

*II. Both transformers in parallel must have equal voltage ratios.* The test in (I) may be repeated with no load on either transformer bank, but substituting an ammeter for the voltmeter. This will give the value of the circulating current due to off-ratio. Reduction in the no-load circulating current may be accomplished by changing tap connections. Ordinarily a circulating current in excess of 10% of the transformer rating is not considered good practice.

*III. The impedances of the transformers should be inversely proportional to their ratings.* Otherwise, the load will not be divided properly. The internal, or impedance drop, of a transformer is the difference between the full-load and no-load voltages. During this test, some means must be taken to insure that the primary voltage does not change. If it does, the primary voltage change must be referred to the secondary by dividing by the ratio of transformation, and a correction applied accordingly. If the voltage reduction from no-load to full-load is the same on both transformer banks, the impedances can be regarded as inversely proportional to ratings.

*IV. The ratios of resistance to reactance should be equal.* Otherwise the currents delivered by the transformers in parallel will not be in phase with each other, or with the load current.

*V. Relative output.* The present delta connected bank of 75 kva. transformers will supply a balanced load of 225 kva. Because the two 150 kva. transformers must also supply current for the open leg of the delta, their available output is only 260 kva., although the combined rating is 300 kva. Available plant capacity of the two banks before interconnection is 485 kva.

Assuming considerations (I) to (IV) are 100% favorable, the balanced-load output of the proposed interconnection is only 375 kva. The 75 kva. transformer standing alone on one side of the delta will be fully loaded when the load reaches 125 kva./phase. The remaining 75 kva. transformers will be working only at 69.5% capacity. Also, the 150 kva. transformers will deliver only 69.5% of the rating.

Since the four transformers which may be placed in parallel on two phases would operate at such low rating, there could be more than normal tolerance

in considerations (II) to (IV). The limiting factor, if efficiency is of no moment, is that no transformer exceeds its rating. This could be tested by taking an ammeter reading on each transformer.

If increased capacity is sought under the described conditions, 190 kva. can be gained by adding a 150 kva. transformer to the open delta bank.—L.E.B.

## Monocyclic System

*QUESTION 326—Will some one please explain the monocyclic system and its use?—E.J.K.*

ANSWER TO QUESTION 326—According to Webster, Monocyclic (electr.) is "designating a certain system or arrangement of armature windings and transmission lines for utilizing currents in a combined lighting and power service".

This definition is, to say the least, inaccurate. With regard to electrical engineering, the term was coined by P. Boucherot some 58 years ago, to designate combinations of reactors and capacitors for converting a-c constant potential into a-c constant current, and vice versa. C. P. Steinmetz in 1897, 1905 and 1917 has developed and extended the theory, and applied it to multi-phase systems. A more proper definition would therefore be: Monocyclic (electr.) is designating arrangements for converting a-c constant potential into constant current, and the converse, whereby the conversion is facilitated by means of inductances and capacitances.

To the best of my knowledge, monocyclic systems have been used but once in recent years, in connection with an experimental high-voltage d-c transmission in Schenectady, N. Y., in 1935. At that time, tube limitations suggested transmission at constant current (10 amps., at voltages up to 15 kv.), preferable to transmission at constant voltage whereby large short-circuit currents could destroy the tubes. For that reason, monocyclic networks were used at both terminals, to change from constant voltage, variable current to constant current, variable voltage at the sending end, and conversely back to constant voltage at the receiving end. Details of this installation were published by Willis, Bedford and Elder in Electrical Engineering, Jan. 1935, p. 102: Constant Current D-C Transmission.

It may be added that high voltage d-c transmission has presently become a rather fashionable subject, particularly among European engineers. Transmission of large blocks of energy over long distances at high voltage


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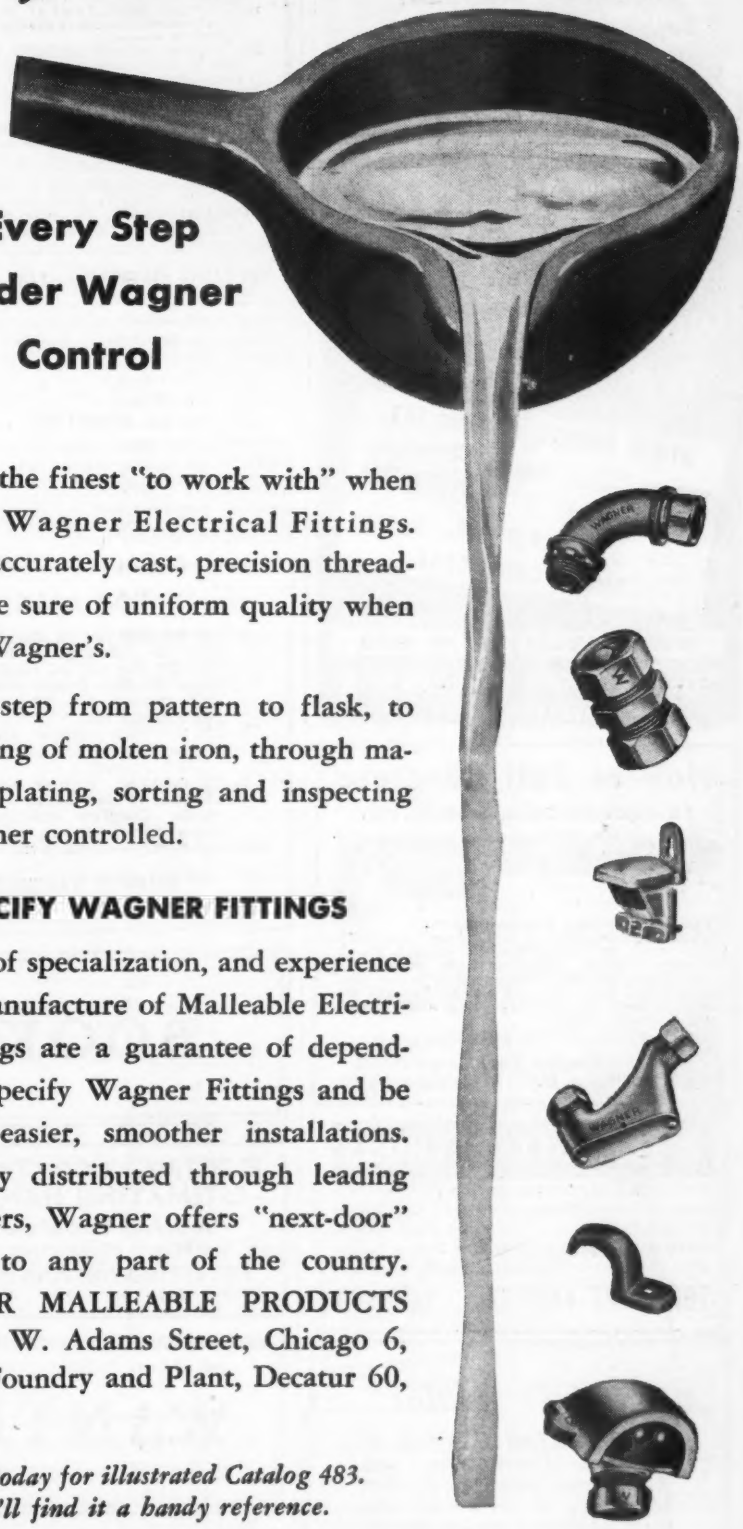

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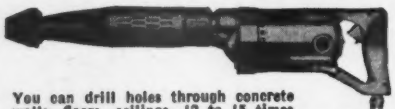

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d-c is indeed attractive. As usual, energy would be generated, and distributed, as three-phase a-c. Modern rectifiers and inverters do not have the limitations of the tubes used in 1935. As a consequence, present-day schemes do not consider conversion into constant current, hence have no need for monocyclic systems.—L.F.R.

A. TO QUESTION 326—The Monocyclic System was a system designed before the present Polyphase system as we know it today.

It was essentially a single phase system. However, a specially designed alternator was made provided with an additional coil—called a "Teaser" which was at quadrature to the main winding. This machine had three collector rings, two for the single phase and the third for the teaser. The teaser wire was smaller than the main two wires and was only run into places which had motors. The third wire made possible the starting of the motors on essentially a single phase system.

I believe Steinmetz was responsible for this system.

The system is now obsolete but before our present polyphase systems, it was an asset in the abilitv it had to start motors.—E.A.M.

## Can you ANSWER these QUESTIONS

**QUESTION G15**—We are planning to install a 2200 volt distribution system, in an underground tunnel feeding several buildings. At the present there is a 3-conductor 2/0 lead covered armored cable installed in the tunnel. It is proposed to tap this cable, and install a branch feeder of a 3 conductor, No. 8 or No. 6 cable to the different buildings, to a bank of transformers. These transformers will not be large, only from 50 to 100 kva. The distance from the junction to the transformers is from 30 to 50 feet.

Now the question arises, what type of junction boxes should be installed, fused or not fused? One party states that, expulsion fuses would be a disadvantage, rather than an advantage, as the branch cables would be protected from overload by the proper fuses for the transformers, and it would be classed the same as an overhead distribution system. But in case of cable failure, it would be some advantage to have some disconnecting means.

If any readers have had experience with installations of this kind, will you please give us suggestions as to what equipment to install.—J.A.W.

**QUESTION H15**—We use electromagnets in the handling of both scrap and billets, both to and from barges on the river water-way. The tow-boat engineers have on occasion complained about the erratic functioning of their compasses when loaded with iron handled by the magnets. This condition is not alone common to them but also has further ramifications that reach out to the owners of ocean going ships, those that do not own a gyro-compass. Since such a compass costs in the neighborhood of $15,000, it means that quite a larger number of tramp steamer navigators dislike partially magnetized iron cargoes.

We are of the opinion that deviation tables can be satisfactorily worked out to compensate for any compass error occasioned by the magnets, depending, of course, on the type of metal in transit. It is also desirable to learn over what period of time the compass remains affected, once the offending cargo has been discharged. Any reader having hydrographic experience with the problem may be able to suggest answers.—P.C.Z.

**QUESTION J15**—Our plant consists of two buildings which have recently been enlarged and connected together.

Each building contains its own substation where transformers reduce 13,200 volts to be distributed at 440 volts (wye with grounded neutral). This 440 volt, 3 phase, 60 cycle power is available at fused panel boxes mounted on steel columns throughout the buildings.

I would appreciate some comments as to whether it would be possible to parallel the load side of a 440 volt panel box in one building with a duplicate panel in the other buildings, and if so, what the procedure would be.—H.P.H.

**QUESTION K15**—How can ignitron tubes which are used for spot welding be tested?—H.S.

**QUESTION L15**—We have a lot of magnetic switches with thermal elements on all of our motors. All of these elements have their respective current ratings marked on them. I would like to know if there is any way of checking these elements inside their respective switches for current ratings, to make sure that they will trip when they are supposed to trip. Many times individuals tamper with elements and I have no way of checking up on this condition.—J.G.

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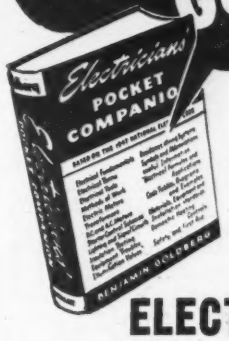


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# Advertising In This Issue


Adam Electric Co., Frank..... 29
Allis-Chalmers Mfg. Co..4, 10, 11, 33
All-Steel Equipment, Inc..... 15
Alter Co., The Harry..... 157
Aluminum Co. of America....24, 123
American Electric Switch Corp... 68
Anaconda Wire & Cable Co..... 69
Appleton Electric Co..... 70
Arro Expansion Bolt Co..... 164
Arrow-Hart & Hegeman Electric Co., The .....125, 126, 169
Artisan Products, Inc..... 124
Associated Research, Inc..... 154
Austin Co., The M. B...130, 151, 178

Biddle Co., James G..... 34
Blackhawk Mfg. Co.....114, 115
Briegel Method Tool Co..... 16
Brown Company ..... 71
Bryant Electric Co., The..... 74
Buffalo Forge Co..... 185
Bull Dog Electric Products Co... 2
Burndy Engineering Co., Inc..... 75
Bussmann Mfg. Co.....72, 73

Century Electric Co..... 120
Certified Ballast Mfrs..... 22
Champion DeArment Tool Co..... 138
Circulators & Devices Mfg. Corp. 182
Clapp & Poliak, Inc..... 146
Clark Controller Co., The..... 36
Concrete Termite Drill Co..... 142
Couch Co., Inc., S. H..... 178
Crescent Ins. Wire & Cable Co... 76
Crouse-Hinds Co. ..... 27
Cutler-Hammer, Inc. ..... 137

Day-Brite Lighting, Inc. ..... 30
Dazor Mfg. Corp..... 80
Dow Corning Corp..... 122

Economy Fuse & Mfg. Co..... 77
Edwards Company, Inc. .....86, 87
Efficiency Electric & Mfg. Co..... 151
Electrical Facilities, Inc..... 136
Electro Mfg. Co..... 8
Electromode Corp. ..... 113

Fairbanks-Morse & Co..... 58
Federal Electric Products Co...31, 134
Feedrail Corp. ..... 32
Frankel Connector Co..... 176
Fullman Mfg. Co..... 172

G & W Electric Specialty Co..... 81
General Cable Corp..... 82
General Electric Co. (Apparatus Dept.).....Second Cover, 5, 7, 174
General Electric Co. (Chemical Dept.) ..... 186
General Electric Co. (Construction Materials Dept.)..Fourth Cover, 158
General Electric Co. (Lamp Dept.) 28
General Switch Corp..... 180
Gibson Mfg. Co. ..... 129
Graybar Electric Co., Inc..... 40
Greenlee Tool Co..... 60
Guth Co., The Edwin F..... 147

Hazard Insulated Wire Works..9, 85, 152
Howell Electric Motors Co..... 118
Hykon Mfg. Co..... 156

Ideal Industries, Inc..... 83
Ilg Electric Ventilating Co..... 88
Industrial Devices, Inc..... 148
Ilsco Copper Tube & Prod. Co.... 152
Industrial Electronics Corp..... 184
Insulation Manufacturers Corp.... 184
Irvington Varnish & Ins. Co..... 171
I-T-E Circuit Breaker Co..... 25

Jenkins Bros. ..... 155
Johns-Manville ..... 18
Johnson Bronze Co..... 153

Kent-Moore Organization, Inc.... 19

Leader Electric Co..... 13
Lightolier Co., The..... 177
Litecontrol Corp. ..... 14
Long Co., W. H. ..... 154

McGill Mfg. Co..... 128
McGraw-Hill Book Co.....150, 152
McGraw-Hill Pre-Filled Electrical Catalogs ..... 156
Midwest Electric Co..... 162
Mine Safety Appliances Co..... 168
Minnesota Mining & Mfg. Co..... 23
Mitchell Mfg. Co..... 167
Monowatt Inc. ..... 141
Multi Electric Mfg. Co..... 155
Murray Hill Books, Inc..... 191
Murray Mfg. Corp..... 1

National Carbon Co., Inc..... 90
National Electric Coil Co..... 153
National Electric Prod. Corp...57, 89

Okonite Co., The.....9, 85, 152
Oliver Iron & Steel Corp..... 91
Onan & Sons, Inc., D. W..... 154
Oster Mfg. Co., The..... 144
Owens-Corning Fiberglas Corp... 145
O. Z. Electrical Mfg. Co., Inc... 96

Paine Company ..... 62
Paragon Electric Co..... 156
Penn-Union Electric Corp..... 93
Pittsburgh Reflector Co..... 20
Plant Maintenance Show..... 146
Post-Glover Electric Co., The.... 26
Powder-Power Tool Corp..... 175
Pyle-National Co., The..... 116

Quadrangle Mfg. Co..... 179

Republic Steel Corp.....94, 95
Ridge Tool Co..... 112
RLM Standards Institute, Inc... 131
Rockbestos Products Corp. ..... 35
Roebling's Sons Co., John A..... 17
Rogers Electric Labs., Inc..... 156
Rohm & Haas Co..... 139
Roll-A-Reel Co. ..... 154

Rome Cable Corp. ..... 12
Russell & Stoll Co., Inc..... 63

Sangamo Electric Co.....97, 165
Sherman Mfg. Co., H. B..... 98
Signal Electric Mfg. Co..... 170
Signal Engineering & Mfg. Co... 173
Simplex Wire & Cable Co..... 110
Solar Electric Corp. ..... 190
Sorgel Electric Co..... 143
Spang-Chalfant (Div. of The National Supply Co.) ..... 100
Square D Co.....Third Cover
Steel City Electric Co..... 103
Steel & Tubes Division.....94, 95
Stemco Corp. ..... 183
Sticht Co., Inc., Herman H..... 157
Stone Mfg. Co..... 157
Superior Carbon Prod. Co., Inc... 188
Swivelier Co., Inc. ..... 99
Sylvania Electric Products, Inc 132, 133
Syntron Company ..... 182

Tal Bender, Inc. ..... 188
Thomas & Betts Co., The..... 105
Topflight Tape Co. ..... 190
Trade-Wind Motorfans, Inc..... 148
Triangle Conduit & Cable Co., Inc. 21
Trumbull Electric Mfg. Co..... 61

U-C Lite Mfg. Co..... 102
United States Motors Corp..... 140
United States Rubber Co..... 6
Universal Motor Co. ..... 150

Van Halst Calculator ..... 150

Wagner Electric Corp. ..... 38
Wagner Malleable Products Co... 189
Weller Mfg. Co. ..... 166
Westinghouse Electric Corp. (Lamp Div.) ..... 101
Westinghouse Electric Corp. (Lighting Div.) ..... 104
Westinghouse Electric Corp. (Pittsburgh) .....78, 79, 84, 92, 149
Westinghouse Electric Supply Co. .....65, 66, 67, 108
Where To Buy..... 190
Wiremold Company, The..... 106
Wodack Electrical Tool Corp..... 190

Youngstown Sheet & Tube Co.. 107


■

## SEARCHLIGHT SECTION

*(Classified Advertising)*


EMPLOYMENT
Positions Vacant ..... 190
Selling Opportunities Offered..... 190
EDUCATIONAL
Books ..... 190
EQUIPMENT
(Used or Surplus New)
For Sale ..... 190
WANTED
Equipment ..... 190